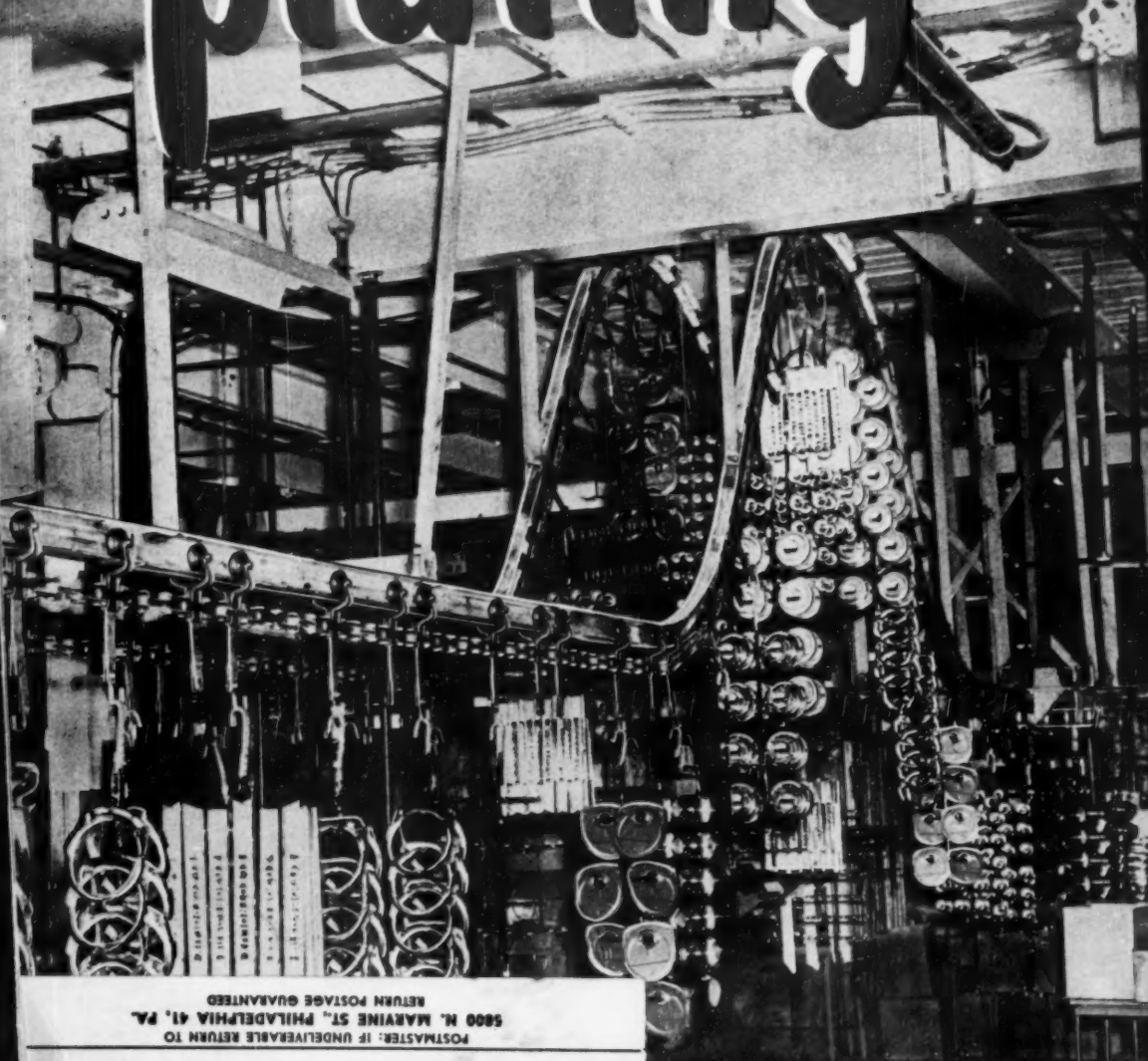
VOLUME 37
NUMBER 2

FEBRUARY, 1950

plating



MODERNIZING A PLATING ROOM

See Contents Page 139

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RETURN POSTAGE GUARANTEED

University Microfilms
313 N. First St.
Ann Arbor, Michigan

A NEW METHOD OF FINISHING

ZINC DIE-CASTINGS FROM DULL TO BRIGHT COLOR

With a One Hour Mechanical Tumbling Operation *

DEBURRING AND FINISHING WITH NON-METALLIC MEDIUMS

Metal	Form	Medium	Compound	*Amount of Compound	*Water	Rolling Time	Finish‡
Zinc Base	Castings	4T Alundum	164-Z	4-5 oz.	4-5 gal.	1/2-1 hr.	Bright

*Weights and volumes are given per cubic foot of mixed work and medium.
‡See page 4 for definition of these terms.

* If the Die-Castings contain cold-shot marks a preliminary cutting down tumbling operation is necessary.

The Complete Process for finishing Zinc Base Die-Casting is given on page 11 of the new Clepo Barrel Finishing Manual.

A Request on your Company Letterhead will bring you this information to you immediately.

FREDERICK GUMM Chemical Company Inc.
538 FOREST STREET, KEARNY, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 76.

Nickel plated steel scissors stripped clean and bright without attack using metal stripper "A"

new Developments For Metal Finishing

METAL STRIPPER "A" — An alkaline chemical stripper for removing coatings of nickel, copper, zinc, cadmium and silver from steel *without any attack* upon the steel. Excellent for removing plated coatings as well as surplus metal from brazing or welding.

CLEANER S-61 —A new alkaline soak-type cleaner that is remarkably effective even at temperatures as low as 150°F. for removal of oil, grease, and buffing compounds from copper and steel.

EBONOL "S-30" — A new quick blackening process for iron and steel. Produces jet black coatings in five minutes.

INHIBITOR 9 — A new inhibitor for both hydrochloric and sulphuric acids for pickling of steel without attack. Saves acids. Also inhibits against hydrogen embrittlement.

NYLON ANODE BAGS — New nylon anode bags for nickel, copper, silver and other plating solutions. Made to specifications.

COMPOUND 42—A new phosphating type compound for rapid removal of rust, oil and grease from large objects. Can be applied by brushing, wiping or spraying.

Write for New Bulletins on these Products

● *Fast action of compound 42 on oily steel.*

Enthone INC.

442 Elm Street, New Haven, Conn.

Announcing...

A Complete Line
of
Spray, Dip and Brush
PHOSPHATE COATING CHEMICALS
for
PAINT-BONDING
RUST PROOFING
and DRAWING

Paint-Bonding **"Granodine"** — zinc phosphate coating chemicals, applied by spraying, dipping, or brushing in a cold, medium, or hot process, improve paint adhesion on steel, iron, and zinc.

"Lithoform" — zinc phosphate coating chemical, applied by spraying, dipping, or brushing at room temperature, makes paint stick to galvanized iron, zinc and cadmium.

Rust Proofing **"Permadine"** — zinc phosphate coating chemical, applied in an immersion process forms an oil-absorptive coating on iron and steel that bonds rust-inhibiting oils such as **"Granoleum."**

"Thermoil-Granodine" — manganese phosphate coating chemical, applied in an immersion process, forms a dense crystalline coating on iron and steel which, when oiled or painted inhibits corrosion and when oiled protects friction surfaces.

Drawing **"Granodraw"** — zinc phosphate coating chemical, used in an immersion process, facilitates the mechanical deformation of steel.

Write for further information on any of these phosphate coating chemicals and processes and how they can be adapted to your production.

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

Industry News

The Electro Chemical Supply & Engineering Company, manufacturer of corrosion resistant cements, coatings and linings, announces the removal of its offices from Paoli, Pa., to its new office and plant at 750 Broad Street, Emmaus, Pa. (near Allentown).

It has recently appointed the **H. D. Fowler Company, Inc.,** of Seattle, Wash., as its agent in the Northwest. Mr. H. D. Fowler, the head of this company, has had long experience in acid and alkali-proof construction work. He has also handled jointing materials for water pipes for many years.

The McAleer Manufactur'ng Company, Ltd. of Canada, Canadian representative for Roberts "Greaseless" and regular compounds, announces the purchase of a three-story building with railroad siding at New Toronto, Ontario. The building comprises 12,000 sq.ft. with additional smaller buildings for the storage of raw materials. After receiving new equipment and modernization of the offices, laboratory, etc., the company will move from Chatham, Ontario.

Chemical Corporation Completes New Laboratory. A new laboratory, complete with modern equipment for research and testing in the metal finishing field, has recently been added by The Chemical Corporation, 54 Waltham Avenue, Springfield, Mass. The company manufactures Luster-on-Zinc Bright Dip and several other metal-finishing specialty products and distributes a full line of platers' equipment and supplies including Pennsalt Cleaners exclusively in New England.

Binai

Binai Manufacturers' Agent in Indianapolis. Walter R. Binai is now a manufacturers' agent at 3916 N. Parker Avenue, Indianapolis, Ind., representing

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1950, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

THIS MODERN MAGIC WILL WORK FOR YOU

Improved

Miccrosol E-1003

Heat-Cured Rack Coating

★ **Amazing Tensile Strength and Scuff Resistance**
★ **Permanent Flexibility**
★ **Positive and Continuous Adhesion**
★ **Simplicity of Application**

Platers who use Improved MICCROSOL E-1003 call its miraculous performance and long life on the job "Modern Magic" . . . magic that steps up production while saving both time and money.

Developed to meet today's severe demands, this vastly improved, rugged rack coating is "modern" in every way. It gives you the utmost in performance, durability, and economy.

If for some reason our salesman in your territory is not contacting you regularly, and you would like some additional information on Improved MICCROSOL E-1003, we will be glad to send you a detailed bulletin. WRITE US TODAY!

MICHIGAN CHROME & CHEMICAL COMPANY
6351 East Jefferson Avenue
Detroit 7, Michigan

MICCRO

AT YOUR SERVICE... **The jobbers listed below are prepared to furnish you with all Miccro Products. Call the one nearest you for immediate service.**

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New York, N. Y.

BELKE MFG. CO., INC.
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Cincinnati, Ohio

DAVIES SUPPLY & MFG. CO.
St. Louis, Mo.

DE LUCIA MFG. CO.
Toledo, Ohio

DONALD SALES & MFG. CO.
Milwaukee, Wis.

ELECTROPLATERS SUPPLY CO.
Pittsburgh, Pa.

EMPIRE ELECTRO PLATING SUPPLIES CORP.
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E. R. FROST COMPANY
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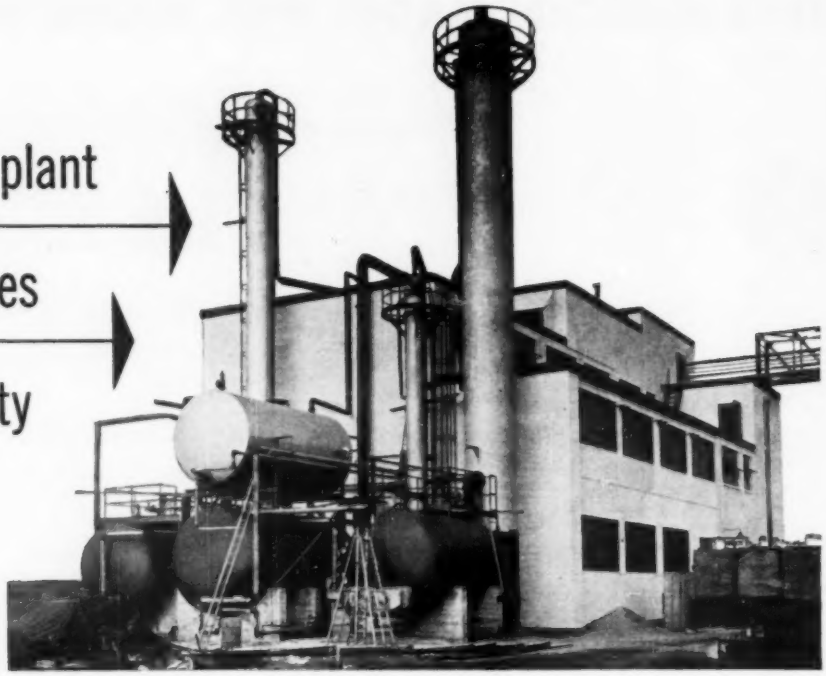
J. WAGNER BROTHERS
Detroit, Mich.

this new plant

assures

quality



NIALK TRICHLORethylene

Are you looking for a thoroughly dependable source of supply for trichlorethylene?

Niagara's new plant for the production of NIALK TRICHLORethylene is completely modern and makes use of special control equipment to satisfy the most exacting requirements for quality and stability.

It is designed to permit increased production facilities—to meet expanding demands.

This coupon brings you a booklet which answers all your questions about NIALK TRICHLORethylene and Niagara Alkali Company. Fill in and mail today.

NIAGARA ALKALI COMPANY

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Liquid Chlorine · Caustic Potash
Carbonate of Potash
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NIALK TRICHLORethylene

Niagara Alkali Company, Dept. A.
60 East 42nd Street, New York 17, N. Y.

Gentlemen: Please send me a copy of your booklet on NIALK TRICHLORethylene.

Name _____

Position _____

Firm _____

Street _____

City _____ **State** _____

CHROME PLATING ADVANCES

MORE PLATING PLANTS THAN EVER REALIZE THE NECESSITY OF USING NO-CRO-MIST IN THEIR CHROMIUM BATHS!

No-Cro-Mist, now used in many thousands of gallons of chrome baths, is a unique soluble liquid agent which reduces the bubble size of the evolved gases upon electrolysis. The primary effect of this phenomenon is to hold back up to 95% of the spray that ordinarily escapes into the air. Thus the atmosphere is kept pure; racks, busbars and ventilating systems stay cleaner, and operations are improved. The average plating plant can also show remarkable savings in heating costs in winter by using minimum ventilation within safety codes. Among the other advantages of No-Cro-Mist are improved covering power of the bath and savings in chromic acid.

ROHCO CROMETER GIVES DIRECT READING OF CHROMIC ACID CONTENT!

Platers are no longer bothered by reference to conversion tables when they use the Crōmeter to determine DIRECT chromic acid content in ounces per gallon at the operating temperature of the chrome tank. Many platers find the Crōmeter, which is a special hydrometer, so useful they keep one in the tank at all times. The Crōmeter is used as an adjunct with the Hull Cell for chrome bath control. It is priced so low that no plater can afford to be without one.

PLATERS CONTROL CHROME BATHS WITH ONLY A 5-MINUTE TEST!

Non-productive bath time plus delays in lengthy plant and outside tests are now a thing of the past. With the Hull Cell Plating Test, chemical analyses of chrome baths are completely eliminated, and optimum catalyst content is maintained at all times, even when several catalysts and other metals are present. Also, the more economical, lower strength, higher efficiency baths may be used because of this simplified catalyst control method.

RINS-AID GREATLY IMPROVES RINSING AND REDUCES STAINING OF CHROME PLATE!

Rins-Aid is a new and important ROHCO product used in very small amounts in a static rinse tank. The effect of Rins-Aid is to form a "duck's back," water-repellent surface on chrome plate so that the rinse water flows rapidly from the surface and leaves it practically dry. The advantages to this improved rinsing are many, including greater freedom from staining, much more rapid drying and imparting a buffed, improved appearance to the surface. Rins-Aid is also equally applicable to other plated surfaces such as cadmium, zinc or nickel; and its very small cost is much more than saved in labor and better work.

ROHCO

ROHCO PRODUCTS

NO-CRO-MIST • HULL CELL TEST • ROHCO 20XL CADMIUM BRIGHTENER ROHCO BARREL ZINC BRIGHTENER • RINSE-AID • CRŌMETER

R. O. HULL & CO., INC.
1277 West 3rd Street
Cleveland 13, Ohio

Canada: Armalite Company, Ltd. Toronto 6, Canada

"YOUR PLATING IS BEST WITH THE HULL CELL TEST"

JUST PIN THIS COUPON TO YOUR LETTERHEAD!

CHECK INFORMATION DESIRED . . . . . .

☐ NO-CRO-MIST

☐ HULL CELL TEST

☐ RINS-AID

☐ CRŌMETER

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1277 West 3rd Street
Cleveland 13, Ohio

Gentlemen:

Please send information as checked.

Name . . . . . .

Company . . . . . .

Address . . . . . .

City & State . . . . . .

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 80.

Industry News

Crown Rheostat & Supply Company, Division Lead Company, Formax Manufacturing Company, Fulton Syphon Company, Industrial Filter & Pump Manufacturing Company, Kocour Company, and Miracle Manufacturing Company. He will also practice as a plating consultant.

Mr. Binai, after graduating from Lehigh University, served as a plating engineer for RCA Victor Corporation 1930-1936. In 1936 he joined P. R. Mallory Company where he developed and operated (until 1945) a high-speed silver plating process for aircraft-engine bearings.

New Packaging of Nickel Brightener Solutions. A new stainless-steel barrel for the shipment of nickel brighteners has been introduced by The Udylite Corporation, Detroit 11, Mich.

Besides easier handling and complete

elimination of breakage, there are savings in freight both ways as the tare weight is reduced. Storage space is reduced by as much as two-thirds because the stainless-steel barrels can be stacked one on top of another. Barrels come in 15-gal capacity vs. 12 gal for a carboy. Pumps fit easily into the ends of the barrel.

Electrodepositors' Technical Society to Celebrate Silver Jubilee. The 1950 Annual Conference, marking the Twenty-fifth Anniversary of the founding of the Society, will be held in Grand Hotel, Eastbourne, from April 19 to 22. A specially attractive program is being planned to appeal to all members, whatever their field of interest in electrodeposition.

Technical sessions are being arranged at which papers will be presented and discussed on electropolishing, alloy deposition, and various other subjects connected with electroplating and protective metallic coatings. Other sessions will consist of general discussions at which well known speakers will introduce topics of such practical interest as metal cleaning, electrical maintenance in the plating shop, and education in the plating industry.

Considerable attention is being given to social functions which members and visitors and their ladies will attend. The Conference will open with an informal social gathering on the evening of Wednesday, April 19. On Thursday evening, the Mayor of Eastbourne will hold a civic reception at the Winter Garden, followed by a dance. The official dinner will take place on Friday evening. Outings and other social events are being planned for Saturday afternoon and evening, concluding with a Dinner and Dance at the Grand Hotel.

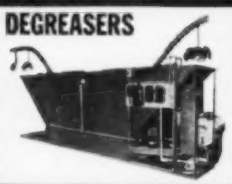
The Conference will be open alike to members and nonmembers of the Society and ladies. Additional information may be had from the Society's headquarters, 27 High Street, Islington, London N1, England.

"New Products for Better Cleaning" was the theme of a recent sales clinic conducted by Cowles Chemical Company at its general offices in Cleveland, Ohio. All Cowles Technical Men in Metal Cleaner Department participated in the three-day session at which several new products were introduced to the sales staff for the first time. It is expected that the first of the new products will be officially announced to the trade within the next few weeks. Technical discussions were led by Dr. C. S. MacMullen, Technical Director, and Clarence G. Ozar of the Metal Cleaner Service Laboratory.

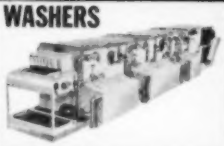
MacDermid Selects West Coast Representative. MacDermid, Incorporated, Waterbury, Conn., recently announced the appointment of **Shepard & Kent, Incorporated,** 3132 East Washington Boulevard, Los Angeles 23, Calif., as West Coast distributor for its line of metal finishing products—Anodex, Dy-

Is METAL PARTS CLEANING a bottleneck in your plant?

DEGREASERS



WASHERS



DRYERS

A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

OPTIMUS VAPOR DEGREASERS are available in all various types and stages, straight vapor, vapor-spray, liquid-vapor and combinations of these. All sizes from simple batch type degreasers to custom built monorail or cross rod conveyor models.

OPTIMUS METAL PARTS WASHERS — single or multiple stage — screw or conveyor, mesh belt or monorail types. Can be applied to a wide range of operations as well as the handling of rust preventatives and other coatings.

OPTIMUS DRYERS embody a specially designed system of directional air jets which assure spotless drying after plating or polishing and before subsequent painting, plating or lacquering.

Submit your metal parts cleaning problem to our engineering staff.

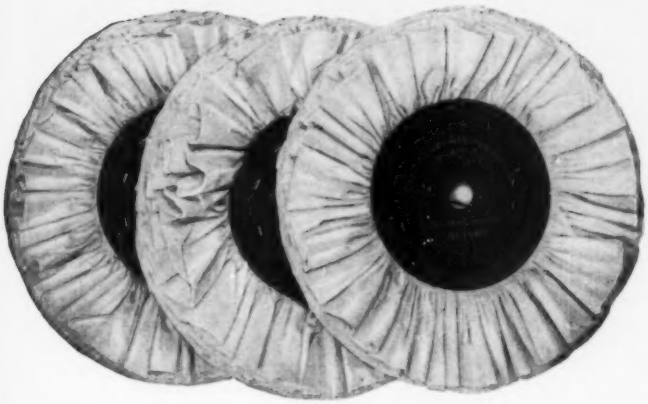
Distributors of
"Midsolv"
A Perchlorethylene Degreaser Solvent
"Triclene D"
A Trichlorethylene Degreaser Solvent

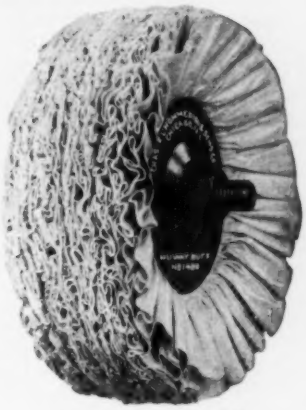
Send for complete catalog and additional information

OPTIMUS EQUIPMENT COMPANY
13 Water Street Matawan, N. J.
Offices in principal cities

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

RELIANCE PRODUCTS





NUWAY BUFFS

MANY FOLDS TO HOLD COMPOSITION USED FOR FAST CUTTING, FLAT AND ROUND SURFACE WORK.

EXTRUDED COMPOSITIONS

MORE COMPACT, NO LOSS FROM BREAKAGE, MORE ECONOMICAL.

RELIANCE MIDGET PLATING BARREL

TUB CAN BE LIFTED OUT FOR DUMPING AND TUMBLING BARREL INSERTED FOR TUMBLING INSTEAD OF PLATING—VERY RIGID—THREE SPEEDS.

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Installed

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Newark, N. J.

W. R. Shields
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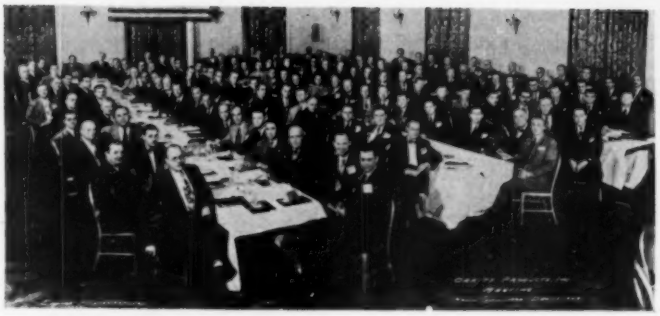
O. M. Shue
Philadelphia, Pa.

Gen. Office and Factory:
1521 Ogden Ave.
CHICAGO

Branches:
Cleveland
and
Los Angeles

clene, Metalex, Rocheltex, MacDermid Bright Copper, and other metal-finishing aids. These materials are all stocked at the above address for immediate shipment. MacDermid's West Coast technical-sales representative, G. Stuart Krentel, became associated with Shepard & Kent on December 1 and will continue to serve former MacDermid customers as well as assuming his new responsibilities.



Oakite Technical Sales Meeting in Hotel Commodore, New York City

Oakite Holds Annual Technical Sales Meetings. Field service representatives from the Canadian, Detroit, New England, New York, and Philadelphia sales divisions of Oakite Products, Inc., attended a series of technical-sales meetings at the Hotel Commodore, New York City, December 15–17. Highlighting these meetings were reports delivered by the company's research chemists and service engineers on latest trends in cleaning and related procedures designed to assist industry in combating rising production costs. Also reported upon were new materials to be made available by the company during the coming year.

Similar regional conferences held at the Sheraton Hotel, St. Louis, December 8–10 and the Biltmore Hotel, Los Angeles, November 28–30 were attended by representatives from Oakite's Chicago, Cleveland, Midwestern, Milwaukee, St. Louis and Southern Divisions, and its North Pacific, South Pacific and Southwestern sales territories, respectively.

Industrial Instrumentation Training Schools being conducted during the first six months of 1950 by Brown Instruments division of Minneapolis-Honeywell Regulator Company at Philadelphia, Pa., will include four short courses of five weeks each and one long course of thirteen weeks.

In addition to the short courses for customers' men to be held during January, March, May and June, intensive courses will be held for specific industries, said M. L. Ladden, chief instructor. The first short course will open January 9, the last will end on June 30. The regular comprehensive 13-weeks course will start on February 27 and will end on May 26. In this, and in the shorter courses, lecture and bench instruction will take up new and improved types of industrial measuring, indicating, and controlling instruments.

YOU WOULDN'T TAKE CYANIDE FOR A HEADACHE

AND IT WON'T CURE RED OXIDE TROUBLES IN BLACK FINISHING EITHER

IF your black oxide finishing production has been slowed, stopped, or disrupted by red oxide forming in the bath, causing inferior finishing and dirty work . . . DON'T USE CYANIDE, as sometimes recommended, to clear this difficulty. Cyanide is only a temporary expedient — no cure — and very hazardous to the operator, as well as costly.

DU-LITE *will guarantee* to eliminate red oxide or any other contamination in *any kind* of black oxide bath without the use of cyanide or other harmful chemicals. This is a strong statement, but we can back it up.

Call in a Du-Lite Finishing Engineer — no obligation — and eliminate these costly troubles today. One of our field specialists is located near you.

THE DU-LITE CHEMICAL CORPORATION

140 RIVER ROAD — MIDDLETOWN, CONNECTICUT

DO IT RIGHT WITH DU-LITE

POSITION WANTED

INDUSTRIAL PLATER

Plater with 10 years' plating experience, the last 5½ years in the industrial field, is looking for a change. Fully familiar with plating of industrial equipment of all sizes and shapes (rolls, rams, cylinder sheets, press plates, and the like), especially in hard chromium. Has had two years at Eastern university. Thirty-five years of age.

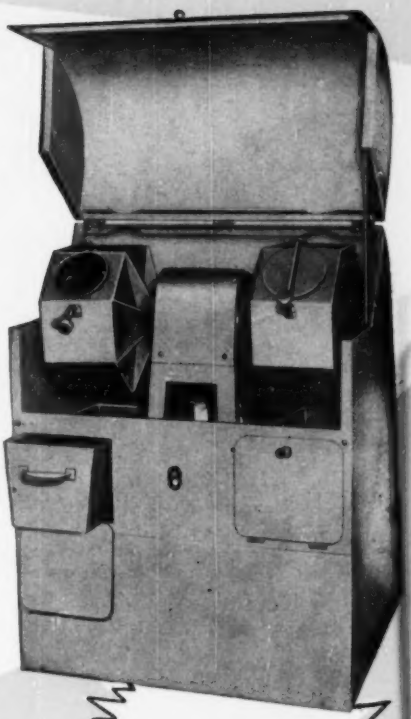
Address reply to:

P-250A, PLATING

P. O. Box 168, Jenkintown, Pa.

New in Precision Barrel Finishing

ALMCO Supersheen MODEL DBO-1



FOR A BETTER FINISH FASTER ON SMALL PRODUCTION RUNS

The *newest* addition to America's Most Versatile Line of Precision Barrel Finishing Equipment. Ideal for small shops, small production runs, experimental processing. All welded steel construction. Sturdily built to take it! Easily loaded and *mechanical* unloading and separating mean *lower* operating costs. *Removable* watertight drawers with drain plugs eliminate need of drainage facilities. Safety hood and chain guard assure *maximum* safety.

It's the last word in compactness, advanced precision barrel design. Write today, Dept. PL-2 for full DBO-1 details.

ONLY $490.00 F.O.B. Albert Lea, Minn.
PROMPT DELIVERY

Cuts Costs up to 90%

Free Engineering Clinics

Eight *strategically* located SUPERSHEEN Engineering Clinics have been established to provide you with *quicker* and *better* sample processing—and to keep you *fully* informed of the latest developments in precision barrel finishing. These are YOUR clinics to use *without obligation*. Bring us your problems and actual parts for sample processing and complete production cost data—OR you may send parts for sample processing if it is not convenient to personally visit the Clinic nearest you.

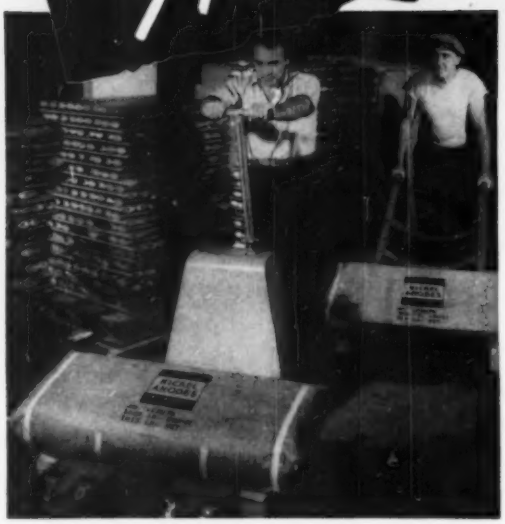
The SUPERSHEEN line consists of (1) Advanced Design *Precision* Deburring and Finishing Barrels in sizes from 8" x 16" up to 60" x 30". (2) *Automatic* loading, unloading and separating equipment. (3) A *vastly* superior grinding and finishing medium in two grades and 9 sizes.

The SUPERSHEEN Process can be applied to produce the *precise* result in a *wider* range of work—from *fast* deburring to the *gentle* honing of stampings, castings, forgings and machined parts . . . even where micro tolerances are a must! The "before and after" photo at left is unretouched.

ALMCO Supersheen

DIVISION OF QUEEN STOVE WORKS, INC.
FACTORY AND GENERAL OFFICES ALBERT LEA, MINNESOTA

HARSHAW *Packaged Anodes**

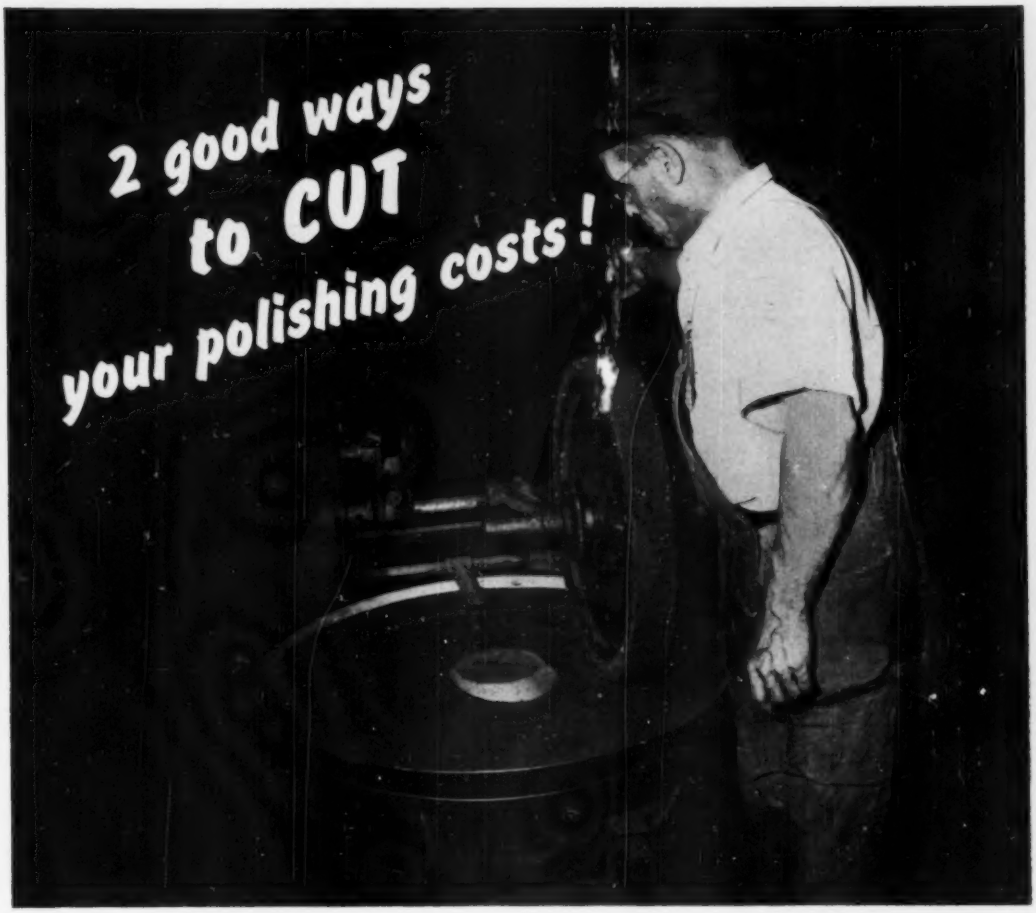


easy to handle
easy to open
no deposit
no return
no extra cost
keeps anodes clean

Harshaw now fills your orders with a compact package of anodes with skids attached. Easy to stack or move by hand or with mechanical truck. When you are ready to use the anodes unwrap the package and throw the wrapping away. No deposits—no containers to return. Order Harshaw PACKAGED Anodes.

*Patent applied for.

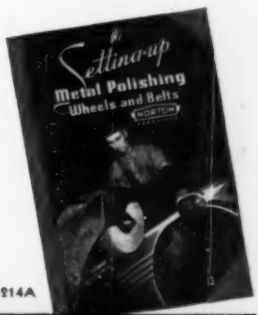
THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES



(1) Take advantage of these cost-cutting features of Norton ALUNDUM Polishing Abrasive: its extreme hardness and toughness; its uniformity of chemical composition and crystal structure; its uniform grain size; its high capillarity; its variety of shapes and types of surface treatments.

(2) Take advantage of the many helpful tips on polishing and setting-up metal polishing wheels and belts offered in this interesting 44-page Norton booklet. Send for your free copy—no obligation of course.

This illustration of a glued wheel being rolled automatically is typical of the many helpful pictures shown in the booklet described below.



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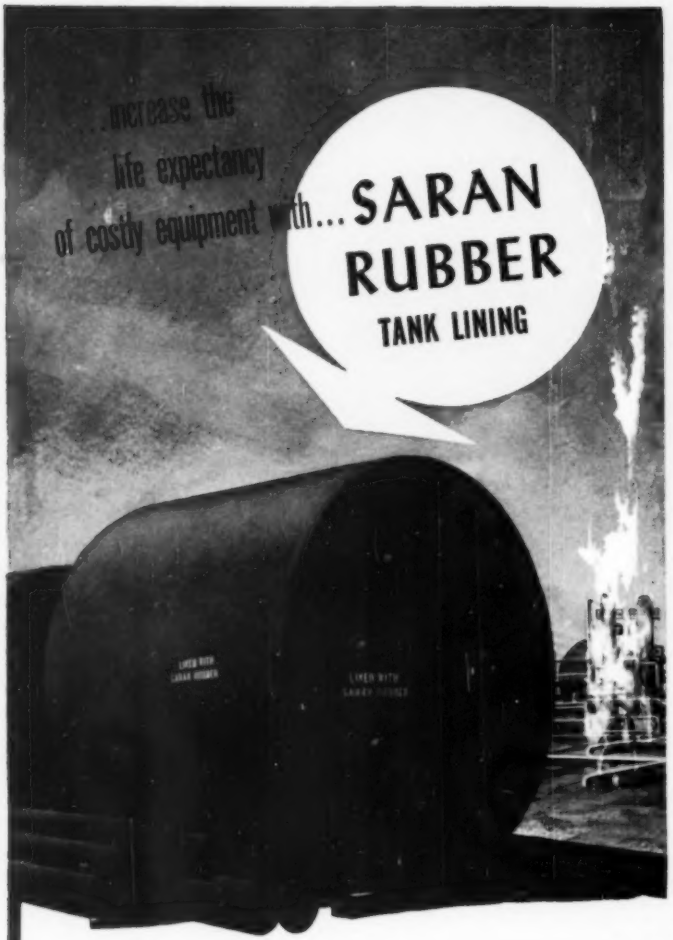
G-214A

NORTON ABRASIVES



Saran rubber, one of Dow Chemical's superior developments in tank linings, has combined the physical properties of rubber with the chemical resistance of saran. This high degree of chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, solvents, acids and other chemicals is indicated.

Saran rubber can be applied easily, effectively and economically by experienced tank lining applicators located strategically throughout the country.

Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office —and find out how you can preserve the life of costly equipment.

Distributed by

Saran Lined Pipe Company

701 STEPHENSON BUILDING • DETROIT, MICHIGAN

Offices in: New York • Boston • Philadelphia • Pittsburgh
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SARAN RUBBER
DOW
product

Personals

P. R. Lyons, previously Hanson-Van Winkle-Munning Company District Manager of Ohio, is now Manager of Electrical Sales with headquarters in Matawan, N. J., coordinating sales of motor generator sets, rectifiers, tank rheostats, and

P. R. Lyons

other electrical products. Mr. Lyons attended the Armour Institute in Chicago after which he engaged in electrical work for the Illinois Steel Company. Following a period of job plating, he joined A. P. Munning & Company in 1925 specializing in conveyor sales in the Chicago territory He continued atthis post after formation of the Hanson-Van Winkle-Munning Company, until 1931 when he was appointed District Manager for Ohio.

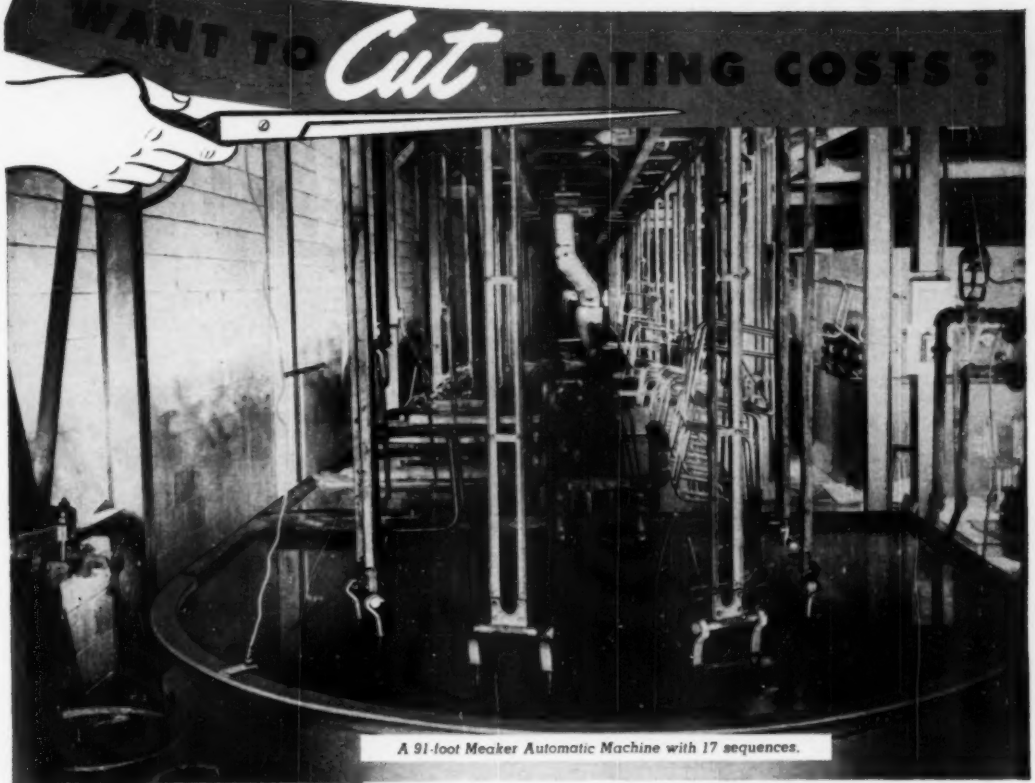
Martvig J. Moll has been appointed Manager of Conveyor Sales. He obtained his engineering education at Columbia University and broke into industry with A. Schrader's Sons, Inc., Brooklyn. After

Moll

four years in the Far East with the Texas Company, he joined Hanson-Van Winkle-Munning Company in April, 1923 to work on the Munning Full Automatic Conveyor which was promoted in that year. One of the pioneers in this field, Mr. Moll has continued active in it throughout the years.

Wilfred G. Cryderman, covering the Southern Ohio Territory, has been transferred to the Cleveland Office. He is a graduate of Michigan State College with a B.S. Degree in Mechanical Engineering. After a period with the Westinghouse Electric Corporation he joined the Hanson-Van Winkle-Munning Company in May, 1946 as Dayton Sales Representative.

WANT TO *Cut* PLATING COSTS?



A 91-foot Meaker Automatic Machine with 17 sequences.

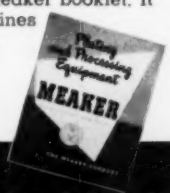
Get Results

with a MEAKER PLATING MACHINE

You save three ways with a Meaker plating machine. In many cases the savings in labor costs, space, and chemicals alone have paid for the Meaker equipment in a very short time. Increased production is a natural result. A better and more uniform plating job is assured. Furthermore, cleaner and more agreeable working conditions reduce personnel turnover to a minimum.

A Meaker machine makes every operation in the plating sequence automatic, or as mechanized as possible. It is the profitable way to do electroplating on a competitive basis. Large percentage savings have been the rule both in the plating departments with medium output and in the mass production plants.

Look to the handling methods in your plating work. There may be an opportunity to save a lot of money. Whatever your requirements call for—full automatic, semi-automatic, or a special machine—Meaker has the answer. Get the Meaker booklet. It shows actual installation photographs of machines that have reduced operating costs for others—these machines can do the same for you.



Ask for Booklet No. 148

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Serving the Plating Industry for over 50 Years

THE MEAKER COMPANY

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PRO MAT

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HIGH QUALITY, ECONOMICAL Zinc Plating and PROTECTIVE FINISHES

PROMAT *Pro-Seal* FINISH FOR ZINC

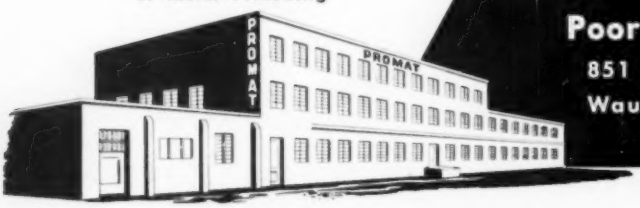
. . . so bright, durable and highly corrosion resistant that it has been adopted by the *majority* of domestic refrigerator manufacturers for the severe service imposed upon refrigerator shelving! The economical PRO-SEAL Finish can be applied to any pure zinc finish by simple dipping. A consistent product is assured by accurate analytical control and the bath can be maintained indefinitely. The *proof* is in a *test!* Submit a sample for PRO-SEAL Finish.

PROMAT C-42 ADDITION AGENT

Use of C-42 gives a high performance, workable and economical plating bath, producing a high quality zinc plate over a *very wide current density range of from 15 to 200 amps per square foot without burning.* Other characteristics — excellent coverage, good striking power, uniform distribution, high rate of deposition.

ALSO Promat Doctor Solution (an outstanding purifier for plating baths) and complete electrolytes and maintenance solutions.

Dedicated to Research for the Improvement of Metal Finishing



PROMAT DIVISION
Poor & Company
851 So. Market St.
Waukegan, Illinois

Personals

Cryderman

Irving A. Gemmell has been designated Assistant Manager of Conveyor Sales. After his graduation from Pratt Institute in Chemical Engineering, he joined A. P. Munning & Company as a student engi-

Gemmell

neer. Following the merger of this company with the Hanson-Van Winkle Company he was assigned to the automatic and semi-automatic conveyor department, and later went to Metropolitan New York as a Sales Engineer.

Gordon R. Lyons has been appointed Sales Representative in Dayton, Ohio. He is a graduate of Case Institute of

G. Lyons

Technology in Mechanical Engineering, 1949. He joined the Army in July, 1943, becoming a navigator of a B-17 who completed thirty-four missions over Germany.

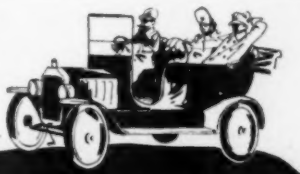
William A. Delger, former Plant Manager, has become Vice-President in charge of manufacturing of The De Vilbiss Company, Toledo, Ohio. **Don J. Peeps,** Chief Engineer, has been advanced to Vice-President in charge of engineering; **John M. Robinson,** Treasurer, has been elected Vice-President and Treasurer; **Frank R. Pitt,** the company's legal counsel, has been named Secretary, and **R. Miles Booth,** member of the treasurer's staff, has been appointed Assistant Secretary and Assistant Treasurer.

Mr. Delger joined De Vilbiss in 1946, after service with an eastern firm as a consulting management engineering supervisor. Mr. Peeps entered the company's employ in 1928 as a factory worker, becoming chief engineer in 1944. Mr. Robinson joined De Vilbiss in 1946 as treasurer, with a background of factory accounting and public tax and accounting work. Mr. Pitt is legislative chairman of the National Paint, Varnish and Lacquer Association.

Elmer A. Terwell is now Sales Engineer in the Chicago territory of Rolock, Inc., Fairfield, Conn., fabricators of heat-and corrosion-resistant alloys. He has had wide experience in the high-alloy field with the Driver-Harris Company and The Salkover Metal Processing Company (of Illinois) and has served as Secretary-Treasurer of the Chicago Chapter of American Society for Metals. His headquarters are at 3382 Avondale Avenue, Chicago 18, Ill.

John A. Stierstorfer has been appointed Senior Synthetic Enamel Chemist at the Stamford (Conn.) branch of the Atlas Powder Company's Industrial Finishes Department. Mr. Stierstorfer brings to Atlas a background of a dozen years in the development laboratories of eastern and midwestern finish and paint manufacturers. He completed his studies at Pratt Institute, Brooklyn, N. Y., and began his career with a paint manufacturer in that city.

Since the Beginning of Mass Production



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Has Pioneered and Developed

METAL PARTS WASHERS

The first metal parts washer was built by Blakeslee . . . an outstanding contribution to mass production methods. Today, Blakeslee metal parts washers are familiar throughout the automotive, aviation and countless other industries.

Whether your finishing operation is enameling, lacquering, machine plating or inspecting, you can depend on a Blakeslee washer. Blakeslee spray, power spray, spiral tumbling or the exclusive Niagara power paddle washing principles, provides a right cleaning method for every type of operation.

Pickling machines, Quenchers and Solvent Vapor Degreasers are also manufactured by Blakeslee. Here you'll find everything you need to prepare your product for finishing.

Engineered for You!

Our experienced staff of practical engineers is ready to help you with your cleaning problems.

G. S. BLAKESLEE & CO.

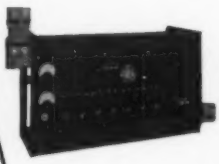
BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

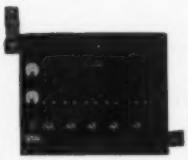
G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

CROWN Equipment

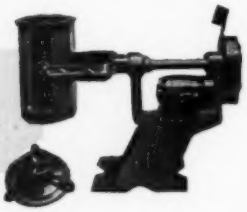
Model 815 Selenium Rectifier



Crown Rheostat with Cut Out Switch



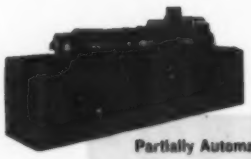
Crown Rheostat



Ball Burnisher

Crown Tumble Finishing Machines

Centrifugal Drier



Partially Automatic

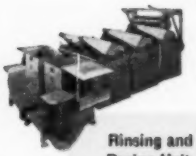
Fully Automatic Plating Machines

Crown Reversing Switch

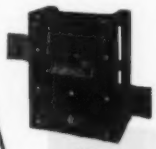
Bench Type Utility Plater

Bottle Type Tumble Finishing Machine

Tilting Type Tumbler



Rinsing and Drying Unit



Crown Disconnect Switch

Plating Barrel

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 NORTH KIMBALL AVENUE • CHICAGO 18, ILLINOIS

MECHANIZE YOUR PLATING DEPARTMENT

ELIMINATE REJECTS • IMPROVE QUALITY • REDUCE COSTS

Personals

Raymond S. McLaughlin has joined the engineering staff of Wire Coating & Manufacturing Company, Cleveland, Ohio. A graduate of Purdue University, he served as a commissioned officer in the Navy during the war. For the past three years he has been associated with the General Electric Company at Erie.

Shannon

R. L. Shannon, formerly a District Manager in the Metal Industries Department, The Diversey Corporation, Chicago, has been named Promotional Manager. He succeeds **B. B. Button,** who has been promoted to the position of special assistant to **W. E. Noyes,** Diversey's General Sales Manager.

Mr. Shannon joined the Metal Industries Department six years ago and, after going through the sales training class, was assigned as a field service representative in the North Chicago sales territory. Subsequently, he was advanced to Field, then District Manager, taking over supervision and management of the entire Chicago sales territory for the Metal Industries Department.

Dr. Harold J. Read, beginning January 1, will devote some time each month to editorial work for PLATING and the *Proceedings*, an undertaking for which he is eminently qualified through previous experience gained with Commerce Clearing House, Inc., the Editorial Board of "Modern Electroplating", and more recently as Technical Editor of the "Journal of The Electrochemical Society".

Dr. Read began his advanced education at the University of Illinois where he held a General Assembly Scholarship and received his Bachelor's and Master's degrees. He then transferred to the University of Pennsylvania where he taught quantitative analysis and electrochemistry while pursuing work for the doctorate. The last year of doctoral work was done under an E. I. duPont de Nemours Fellowship. An association with Dr. A. K. Graham was formed and they became co-authors of several papers.

After a period of post-doctorate teaching at Pennsylvania, Dr. Read went to the Mellon Institute for Industrial Research where he worked on several projects of diverse nature. In 1945 he returned to teaching as Associate Professor of Metallurgy at The Pennsylvania State College, the position he now holds. His interests have been varied, and his publications include, in addition to those dealing with plating, contributions in the fields of chemical engineering, electro-organic chemistry, quantitative analysis, and metallurgy.

✝ **C. M. Campbell,** chemist and plating room foreman with the Crane Company for the past twenty years, passed away on December 30, 1949 in Florida, 54 years old. Funeral services were held in Ocala, Fla., on January 1.

Mr. Campbell was a graduate of University of Illinois and for many years a member of the Chicago Branch, American Electroplaters' Society. He is survived by his widow, Louise; a daughter, Mrs. Robert Anderson; and two sons, C. W. and R. L. Campbell.

PLATING—
HARD CHROME PLANT

Ohio industrial city 30,000 population; fully equipped plant; 30x60; four-room cottage; three acres; property optional.

APPLE COMPANY, Brokers,
Cleveland, Ohio

SALESMAN

wanted who is calling on electroplaters or allied trade. Old established line backed by consistent advertising. Good repeat business. Straight commission but will give exclusive territory. Complete factory cooperation. No objection to other lines if not competing. In reply state territory now covered regularly and present lines. All letters confidential.

Reply to:

P-250B, PLATING,
P. O. Box 168, Jenkintown, Pa.

ABBOTT BURNISHING BALLS

Diameters from 3/32" to 3/8". Used to produce the smooth lustrous finish on flat surfaces. Parts with odd shapes, contours and sharp crevices as well as flat surfaces might require the mixture of one or more of the Abbott Materials with the balls to obtain efficient results. Send a few samples of your parts for our complete finishing analysis . . . there's no obligation.

Each has its job to do — balls, pins, cones, oval-balls, diagonals — each in reality is a burnishing tool scientifically designed to make effective contact on any size and shape of metal stamping or casting. Abbott Materials are not rejects or "cast-offs". They are made from high quality Abbott bearing ball steel, deep hardened, clean and polished to a mirrorlike glass hard finish. Abbott Materials give remarkable results — the results you must have to meet today's cost requirements . . . Try Abbott!

Catalog gladly sent. Abbott Burnishing Materials & Bearing Ball data, charts, etc.

ABBOTT

THE ABBOTT BALL COMPANY
1054 New Britain Ave., Hartford 10, Conn.

THIS
Jackson Airway
Ventilated Buff
PLUS
The Jackson
Factory-trained
Representative
EQUALS
MORE PRODUCTION PER
BUFFING WHEEL DOLLAR

Your 1949 Buff investment

TEAR THIS OUT of the magazine and hand it to your auditor.

Ask him ***how much money you spent on buffs in 1949.***

He probably will say . . . ***"Why do you want to know?"***

Tell him because the JACKSON BUFF CORPORATION claims that they can ***save 25% to 50% on buffs.***

We ***all*** will then know what we are talking about.

Your auditor will say . . . ***"What are you waiting for?"***

We, too, say . . . "What ***are*** you waiting for?"

JACKSON BUFF CORPORATION
21-03 POTTS POINT AVE., LONG ISLAND CITY 1, N. Y.

HEATBATH CORPORATION

announces

THE NEW CONTROLLED OXIDATION PENTRATE FOR RAPID, ECONOMICAL BLACK OXIDE FINISHING OF STEEL.

A new method and product that is 25 to 50% faster in action and lower in cost compared to other products in use today.

The new Pentrate is unique, fool-proof, and easy to operate.

Steel parts are finished a dense jet black in solutions that are under control at all times and operate at peak efficiency.

Controlled oxidation was designed to meet all black oxidizing requirements for single and double bath operations.

A BRAND-NEW PRODUCT!

Easy, Rapid, Lower Costs

The new Pentrate is a development resulting from 25 years' experience in black oxide finishing.

Heatbath Corporation has produced more black oxide finishing products since 1925 than all other makes combined.

Write for Data Sheets describing the new Controlled Oxidation Pentrate.

HEATBATH CORPORATION
SPRINGFIELD 1, MASS.

In Canada: Wm. J. Michaud Co., Ltd., Montreal, Quebec

Fill in Coupon and mail today!

HEATBATH CORPORATION P-1
Springfield 1, Mass.

Please send me new data sheets on Controlled Oxidation Pentrate.

Name

Position

Firm

Address

The Mailbox

Subject: Standard Salt Spray Panels

DEAR SIR:

In reading the A. E. S. Research Report in the November, 1949 issue I was a bit surprised to note the captions used for the pictures of the inspection photographs (p. 1144).

There are no such things as "A.S.T.M. Standard Salt Spray (fog) Panels". The photographs used by Subcommittee H of A.S.T.M. Committee B-8 are as yet entirely unofficial insofar as A.S.T.M. itself is concerned and were prepared simply to facilitate the inspection of atmospheric-exposure test specimens. The committee is, of course, pleased that A. E. S. Project No. 5 has found them useful for rating its salt spray (fog) panels and is entirely agreeable that Project No. 5 use them for any purpose it wishes. We must, however, be very careful to avoid misleading any reader into the belief that official salt spray (fog) inspection standards have been established by A.S.T.M. I am sure you will appreciate the confusion which may result at A.S.T.M. Headquarters should such a misunderstanding become widespread.

Committee B-8 expects eventually to establish one or more series of "official" A.S.T.M. inspection standards for plated coatings and is constantly working toward that end. Certain of the illustrations in the present series, however, are not entirely suitable and will be changed when more suitable photographs become available.

Very truly yours,

C. H. SAMPLE,
Chairman, Committee B-8
American Society for
Testing Materials

Subject: Rinsing

DEAR SIR:

There is an error in the last paragraph of Joseph B. Kushner's letter as published in the "Mail Box" in the November issue of PLATING. Mr. Kushner doubtlessly refers to Project No. 5 entitled "The Effect of Impurities and Purification of Electroplating Solutions" instead of Project No. 6 which concerns the porosity of electrodeposited metals.

Water control in the plating room not only has high significance because it conserves water and salts and promotes quality but is also economically and politically important since there is a direct relationship between the amount of waste running to a sewer and the difficulty in disposing of it. Plants designed to handle large volumes of mixed wastes of low concentration are much more expensive and complex than plants for the treatment of small volumes of concentrated segregated waste. The trend of some findings of A. E. S. Research Project No. 10, "The Disposal of Plating Room Wastes", indicates that means will be provided for the small to medium-sized plant to treat segregated and accumulated wastes batchwise at a very reasonable cost. It logically follows that water control will be required to provide these segregated and concentrated wastes.

Very truly yours,

W. M. TUCKER
Chairman, A. E. S.
Research Committee

SITUATIONS OPEN

TOP FLIGHT MANUFACTURING AGENTS AND JOBBERS Wanted in certain territories to sell Schaffner's Buffing Compositions and Supplies. We specialize in White Finish (Lime, Compositions), Grease Stick, Tripoli, Emery Cake, etc., in "Bar or Liquid Form". All up to 100 per cent saponifiable. These items can all be made to fit your particular customers' requirements. No account is too small or too large for our individual attention.

SCHAFFNER MANUFACTURING COMPANY
SCHAFFNER BUILDING
PITTSBURGH 2, PA.

Whether you require a nickel finish with superior cutting qualities —or a 100% saponifiable composition for coloring prior to chrome plating, we have a SPEEDIE Bright Gloss Composition for you —for instance:

- No. 86-D — an old standby — can't be beat for buffing and coloring on nickel. Medium greasy, sticks to the wheel.
- No. 2119 is 100% saponifiable —does an outstanding job of coloring nickel. Highly recommended for work which is to be chrome plated.
- No. 1931 was especially developed for cutting on heavy work such as bumpers. Used with outstanding success on difficult buffing operations.

Learn about the complete line of *top quality* SPEEDIE Buffing and Polishing Compositions. Whatever your problem, there's a job-proved *SPEEDIE* product to help you — Tripoli, Stainless Steel, Satin Finish, Emery Cake, Grease Stick, etc.

Polishing Room Supplies and Equipment

BP THE BUCKEYE PRODUCTS CO.
7032 Vine Street Cincinnati 16, Ohio
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Now you can get...
BETTER FINISHES, BROADER USAGE
for ZINC AND CADMIUM
with IRIDITE
for

CORROSION RESISTANCE, PAINT ADHERENCE, FINAL FINISH... BRIGHT, CHROME-LIKE OR COLORED

The only complete line of patented chromate-dip treatments to meet your particular finishing problem.

Iridite *quality* is *tops* in corrosion resistance and paint bond. Iridite finishes are *first* in wide selection of coatings:

BRIGHT: Chrome-like in appearance

BRONZE: Natural as bronze itself

OLIVE GREEN: A popular replica of Military Olive Drab.

HUE BRITE: Clear; eye-appealing iridescence

COLORS: Black, Red, Blue, Green

PROCESS METHOD: Simple dip chemical immersion for a matter of seconds

SURFACES: Zinc or cadmium: plated, die cast, galvanized or sheet

COST: The smaller fraction of a penny does a square foot of surface

FREE—Write for literature and samples, and for immediate action, send us a sample of the product you wish to process, along with the outline of your problem.

SPECIAL PROCESSES—*Research and new developments in general metal finishing are being carried forward as manufacturers present new finishing problems for us to work out.* ***Let us go to work on yours.***

IRIDITE LICKED THESE FINISHING PROBLEMS—Washing Machine Parts • Radio Equipment • Kitchen Utensils • Aircraft Parts • Lock Hardware • Office Machines • Window Frames • Vending Machines • Tools • Lamp Fixtures • Fuel Pumps • Carburetors • Auto Hardware • Zinc Coated Sheet • Hinges, Screws, Bolts • Camera Parts • Plumbing Fixtures • Wall Panels • Refrigerator Parts • Wire Products • Instrument Parts • Electrical Equipment • Armed Forces Materiel.

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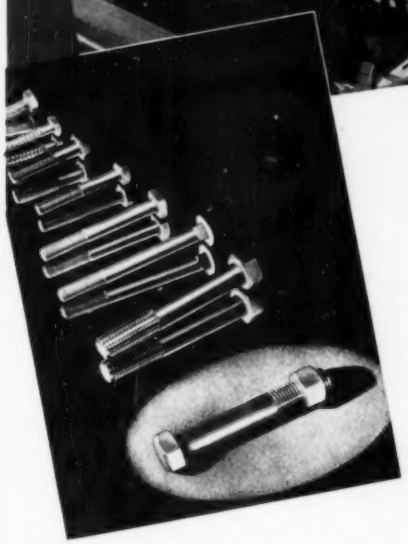
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 95.

"All Our Plants Use *Udylite* Equipment"



Products of Russell, Burdsall & Ward Bolt & Nut Co. cadmium-plated by Udylite Barrel equipment at their Port Chester, N. Y., plant. This firm also has plants in Pennsylvania, Illinois and California, all using Udylite equipment.

Says Russell, Burdsall & Ward Bolt & Nut Co.

"It Gives Our Products Greater Customer Acceptance!"

EVERY DAY alert manufacturers like Russell, Burdsall & Ward Bolt & Nut Co. are turning to Udylite plating equipment for fine finishes and dependable operation.

They've found both Udylite automatic and barrel equipment give their products better, more uniform metal finishes at lower cost.

Udylite automatic equipment reduces direct labor costs, holds maintenance to a minimum and requires less floor space per unit.

Udylite barrel equipment for cyanide and acid baths, is noted for rugged construction and low-cost operation.

Add up these advantages and you'll see why Udylite plating equipment is your best investment.

In addition, Udylite offers *complete* plating service—before and after installation. If you are planning a new installation or if you face a plating problem with your present equipment—it will pay you well to call in your Udylite Technical Man. He'll be glad to help you at any time—without any obligation. Call him today or write to us direct.

PIONEER OF A BETTER WAY IN PLATING

THE *Udylite* CORPORATION
DETROIT 11, MICHIGAN

HOW MASTER LOCK COMPANY cut metal cleaner consumption 33⅓% ...with PENNSALT CLEANERS

The Master Lock Company, big name in the padlock industry, was looking for a metal cleaner that could do a universal cleaning job prior to plating. This cleaner had to remove oils from steel and brass parts in washers, in barrel cleaning, in soak cleaning, and electro tank cleaning equipment. Typical parts are shown above.

The Pennsalt field technician recommended a streamlined cleaning procedure built around one of Pennsalt's fused alkaline cleaners.

Then things really came clean. Cleaning material consumption was cut ⅓! In comparison to the previous cleaner, Pennsalt gave better results for less money.

That's the kind of service manufacturers are getting from Pennsalt. And the kind of economical result:—production costs cut! Check your Pennsalt representative, he can give you the full story on the Pennsalt Metal Preparation Service. Or write: Special Chemicals Division, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT
metal cleaning compounds

Trade Literature

L—334. Reducing Agent—Product Development Department, Mathieson Chemical Corporation, 60 E. 42nd Street, New York 17, N. Y., announces that dihydrazine sulfate is now being produced in semi-commercial quantities for the first time and is available in one-pound bottles and drums. Containing 37.5 per cent available hydrazine, the salt is a flaked product. It is said to have 60 per cent higher hydrazine content than hydrazine acid sulfate and twenty times the solubility.

Suggested applications include its use as a catalyst in polymerization of vinyl-type resins and as a reducing agent in metal-finishing operations.

A technical data sheet, No. 124.1 on dihydrazine sulfate is available. For your copy, use Reader Service Card.

L—335. Straight Line Polishing and Buffing Automatics—Acme Manufacturing Company, 1645 Howard Street, Detroit 16, Mich., has prepared an 8-page 2-color illustrated bulletin describing its various types of reciprocating and forward-moving equipment for finishing of all kinds of parts. Of special interest are the camming fixtures employed. For your copy, use Reader Service Card.

L—336. Rubber and Plastic Linings—Metalweld, Inc., 26th Street and Hunting Park Avenue, Philadelphia 29, Pa., offers a 4-page illustrated bulletin describing the processes it employs and its facilities. For your copy, use Reader Service Card.

L—337. Liquid Buffing Compound—The Liquimatic tripoli-type buffing compound manufactured by J. C. Miller Company, Grand Rapids, Mich., is described in a 4-page 2-color bulletin. It sets forth the properties of the material and the advantages in its use and illustrates the setup employed in its application. For your copy, use Reader Service Card.

L—338. Preparation of Nonferrous Metals for Painting—A 4-page illustrated Technical Service Data Sheet No. 3-2-210, describing the Duridine treatment for cleaning and paint conditioning of aluminum, zinc and other nonferrous metals, has been issued by American Chemical Paint Company, Ambler, Pa. Of special interest are the typical process sequences suggested for highest-quality mass production or for use where difficult cleaning problems are encountered. For your copy, use Reader Service Card.

L—339. Rotary Wire Brush—Hewitt Rubber Division of Hewitt-Robbins, Incorporated, Buffalo 5, N. Y., offers a 3-page illustrated bulletin and price list

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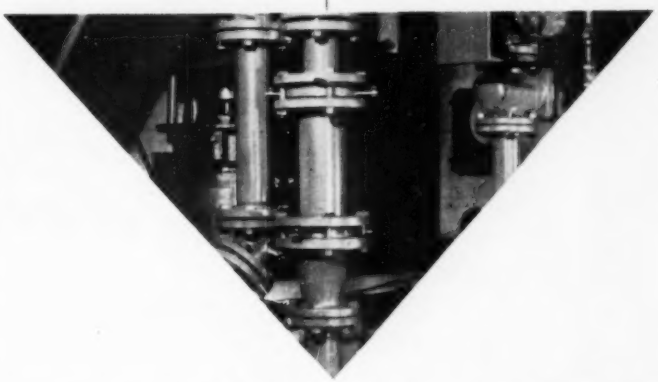
available immediately — readily field fabricated

resists corrosion



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describing its Rubberlokt Rotary Wire Brush. The wire bristles are embedded in a rubber core, whereby vibration and hence worker fatigue and bearing wear is reduced. The flange construction keeps the wires in upright position giving more brushing points, a smoother job, and less wire breakage. For your copy, use Reader Service Card.

L—340. Chromium Plated Gages—The Cro-Plate Company, Inc., 3343 Main Street, Hartford 5, Conn., offers full lines of chromium plated "Cro-size" go-no-go and progressive-limit cylindrical plug gages, as well as cylindrical ring gages, described in a 4-page illustrated bulletin. Prices are said to be those for ordinary steel gages and worn "Cro-size" gages are salvaged. For your copy, use Reader Service Card.

L—341. Grinding and Polishing Equipment—The Hill Acme Company, 1201 W. 65th Street, Cleveland 2, Ohio, has issued a 3-page bulletin showing its divisions and the products they manufacture, including grinding and polishing machines for sheets and special shapes. For your copy, use Reader Service Card.

L—342. Centrifugal Pump Installation and Operation—A revised instruction manual, Bulletin 812A, on the installation and operation of centrifugal pumps in corrosive service has been issued by The Duriron Company, Inc., Dayton 1, Ohio. While dealing specifically with Durcopumps, the information in the twelve varnished, smudge-proof pages is applicable to all centrifugal pumps. The booklet deals with proper location, proper foundations, correct alignment, priming of standard pumps, proper piping arrangements, adjustment of impellers, and common troubles and how to overcome them. Friction data, formulae for figuring capacity, head and horsepower, and conversion data are also included. For your copy, use Reader Service Card.

L—343. Drum Handling—Bulletin No. 44-949 issued by Morse Manufacturing Company, Syracuse 2, N. Y., describes and illustrates the Morse "Rock-A-Drum" Vertical Drum Truck with which one man can easily and safely position heavy drum loads of paints, lacquers, and chemicals 15 inches above the floor for side drainage. Portability of the "Rock-A-Drum" truck enables user to transport easily heavy drum loads to any location. For your copy, use Reader Service Card.

L—344. Engineering and Production Equipment—Continental Industrial Engineers, Inc., 176 W. Adams Street, Chicago 3, Ill., consultants, engineers, and manufacturers of completely equipped

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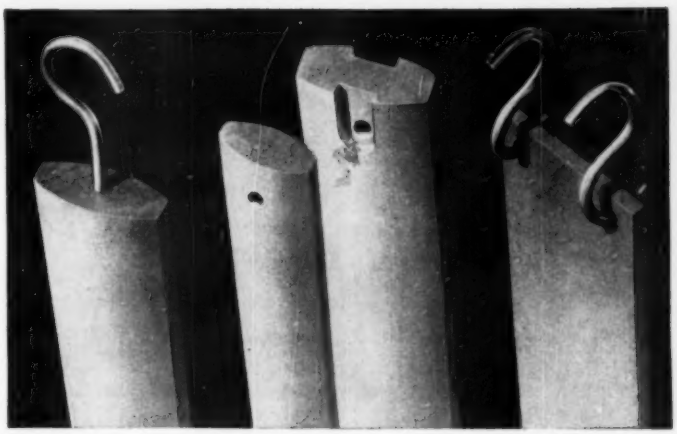

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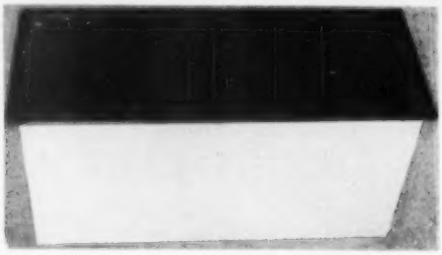

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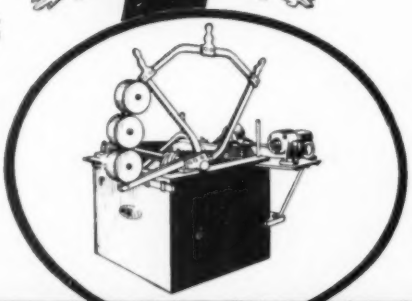

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Trade Literature

plants, production lines, special machines and heat-processing equipment, has issued a new 12-page booklet No. 127 describing in detail the broad scope of their services to industry. Included are many illustrations with detail descriptions of a wide variety of production lines and automatic processing equipment for metal coating, bright annealing, and organic-finish drying. For your copy, use Reader Service Card.

L—345. Finishing Publication—"Modern Metal Finishing" is once more being issued by the duPont Company. The October, 1949 issue, No. 1, Volume 7, the first since June, 1941, has been circulated.

"Vapor Degreasing", describing this modern metal cleaning process, and "Carbonate Removal from 'Coppralyte' Copper Plating Baths", are features of the first issue. Other articles are on sodium hydride descaling; free-washing carburizing baths; vapor cleaning of metal mouldings; and a new copper-plating filter aid. For your copy, use Reader Service Card.

L—346. Stainless Steel Pickling and Heat Treating—Comprehensive, up-to-the-minute information on heat treating and pickling methods for stainless steels is contained in a new 36-page booklet, "Heat Treatment and Pickling of Armco Stainless Steels" published by Armco Steel Corporation, Middletown, Ohio. It is well illustrated with pictures, diagrams, graphs, and tables which describe practices and equipment for use with common industrial alloys. For your copy, use Reader Service Card.

L—347. American Standards Price List—The 1124 standards approved to date by the American Standards Association, 70 E. 45th Street, New York 17, N. Y., are listed and their prices given in a revised 28-page booklet which also includes an alphabetical index. For your copy, use Reader Service Card.

L—348. Personal Protective Equipment—The 1949–1950 issue of "Everything in Safety", issued by E. D. Bullard Company, 275 Eighth Street, San Francisco 3, Calif., is a complete catalog of personal protective equipment and industrial safety devices. It is divided into five sections: First Aid, Respiratory Protection; Eye Protection; Hats, Belts, and Clothing; Miscellaneous Safety Equipment. For your copy, use Reader Service Card.

L—349. Airless Blast Cleaner—A 48-inch continuous Wheelabrator "Tumblast", newest addition to the line of the American Wheelabrator & Equipment Corporation, 555 S. Byrkit Street, Misha-

MICRO-POLISH unit showing accessible controls and neat compact design.

MICRO-POLISH unit with cabinet removed to show interior construction.

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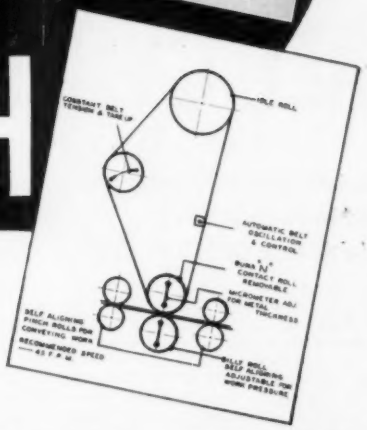
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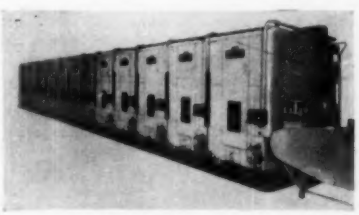

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Trade Literature

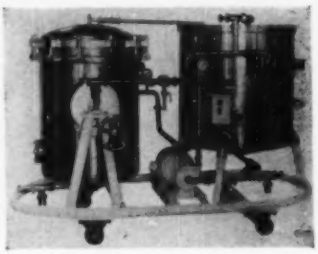
waka, Ind., is announced in a new catalog with pictures, drawings and phantom views of operating parts of the machine. For your copy, use Reader Service Card.

L—350. Tank Heating and Cooling—Tank heating and cooling is described and illustrated in a new 6-page bulletin, "Platecoil", just released by the Kold-Hold Manufacturing Company of Lansing, Mich. A direct comparison is made between the Platecoil and pipe-coil methods of heat exchange. The bulletin shows how the former takes only half the tank space, yet heats faster than pipe coil. Ten advantages of Platecoil are described pertaining to savings in time, money, and manpower. For your copy, use Reader Service Card.

L—351. Corrosion Resistant Linings, Coating Materials, and Sheeting—Industrial Lining Engineers, Inc., 3527 Smallman Street, Pittsburgh 1, Pa., offers a series of Data Sheets describing its many protective coatings for tanks, fans, pumps, racks, baskets, anode bars, etc. For your copies, use Reader Service Card.

L—352. Spray Booth Compounds—A 4-page folder issued by Fidelity Chemical Products Corporation, 430 Riverside Avenue, Newark 4, N. J., describes four types of spray-booth compounds, two for coating dry booths and two for the treatment of water solutions in water-wash booths. These are specialized materials for varying types of paint and enamel oversprays. For your copy, use Reader Service Card.

L—353. All-Metal Filter—Green Manufacturing Company, 4539 W. Armitage Avenue, Chicago 39, Ill., in a 4-page bulletin, describes and illustrates a line of stainless-steel filters with filtering areas



from 6 to 180 sq.ft and pumps from 0.5 to 5 hp. Filtering takes place through tubular screen-wire elements coated with filter media. The filter is cleaned by back washing. For your copy, use Reader Service Card.

L—354. Plant Ventilation—Mechanical ventilation of industrial structures to remove air contaminated by fumes, dust, or gases necessitates replacing the air. How this can be accomplished efficiently and economically is described in a new illustrated Bulletin 520, published by the Heating Section of Dravo Corporation, 5th and Liberty Avenues, Pittsburgh 22, Pa., believed to be the first study of its kind.

Removal of large volumes of air from a building without replacing it causes negative atmospheric pressure that hampers the proper function of exhaust fans and upsets the combustion balance for ovens or process equipment resulting in poor efficiency. Moreover, in some cases, a supply of fresh outside air protects plant machinery from abrasive or corrosive action of air contaminants.

The "Dravo Counterflo" Heaters described in the brochure perform a triple function: drawing in the air from the outside, heating it to desired temperature and distributing it uniformly and without drafts throughout the working area. During the summer the air can be brought in and distributed without heating. For your copy, use Reader Service Card.

L—355. "The Story of the Chemicals You Live By"—A 16-page booklet which describes eight major groups of chemical products and depicts their diverse utilization throughout American industry—has just been issued by Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio. It reviews soda ash, caustic soda, chlorine, bicarbonate of soda, silicates, calcium carbonates, chromates, and specialty chemicals, pointing up the economic significance of each group. For your copy, use Reader Service Card.

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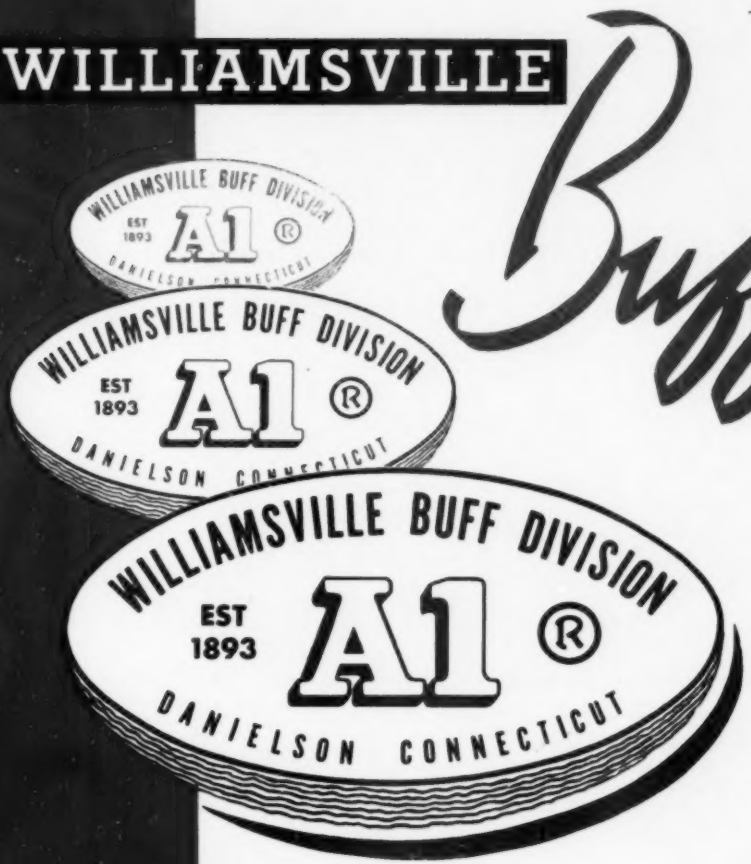

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2—3000 Amp. Electric Products

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1— 300 Ampere, 25 V. Star
1— 175 Ampere, 25 V. Cr. Wh.

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2— 100 Ampere, 30 V. Gen. Elec.
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1—1000 Ampere, 33 V. Gen. Elec.
2— 500 Ampere, 40 V. Chandeysson
2—1000 Ampere, 40 V. Chandeysson
2— 200 Ampere, 42 V. Gen. Elec.
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In the above photo, operators are buffing fountain pens already filled with ink. Note redesigned hoods which keep room clean and free from dust.

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On the roof of the Eversharp plant, KIRK & BLUM relocated an old collector for greater efficiency and installed this new collector.

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FEBRUARY, 1950

plating

FEBRUARY 1950 VOL. 37 NO. 2

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- Prime *all* zinc surfaces for paint, enamel, or lacquers.

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Editorial

Closing the gap

IT HAS BEEN COMPLAINED in Great Britain that there is a gap between research results and application in the plating room. The same, unfortunately, is often true in the United States, particularly in the medium-sized and smaller shops. It is easy to say that this is because of laziness or lack of progressiveness on the part of the plater, but that is probably an incorrect diagnosis in most cases. What then is the cause?

One reason seems to be that the plater is often too busy—with the wrong things. He spends a good part of his time seeing to it that Joe and Jack and Bill have work to do; handles each and every little squabble that arises in the shop; sometimes makes all minor repairs, for example on racks; and, even worse, steps in and works as a tank man when the shop is busy. The first step that such a plater must take is to get himself an assistant who can handle all purely routine matters and himself take a hand only when absolutely necessary. If the plater has analyzed his own solutions he can well place that burden too on his assistant's shoulders.

Having acquired some time, the second step, which many a plater has not taken, is to study his own costs as well as learn how to estimate costs from projected procedures. No management worthy of its name will authorize capital expenditures unless it can see benefit in dollars and cents. It will be agreeably surprised when it finds that more cost reduction can often be accomplished in the polishing and plating room than in either the machine shop or the stamping plant.

The third step is to get a suitable experimental setup for testing new processes. A set of small tanks and crocks in a corner with the necessary auxiliary equipment will serve for the initial tests, and a few somewhat larger tanks, placed so that a portion of the production can be routed through them, for the final tests.

The plater is now in a position to translate what he reads in journals like PLATING and hears at meetings of The American Electroplaters' Society into terms of his own shop, try out promising leads for applicability, and find out what costs will be with the new procedures. The problem of selling them *and himself* to the management will have been greatly simplified. The gap will be closing.

Gustaf Soderberg

ABSTRACT

A limited survey was made of the behavior of a nickel fluoborate electrolyte containing excess boric acid. Nickel plated from it was tough and ductile and showed 30 per cent less contractile stress than deposits from a Watts bath. Anode and cathode efficiencies were high, and the electrolyte conductivity was as high as that of the all-chloride nickel bath. A disadvantage is the corrosiveness of the fluoborate bath which precludes use of some common materials but can be resisted by modern equipment. All factors being taken into consideration, including its well known high buffering capacity, it was concluded that the fluoborate solution is a practical, easily controlled bath to employ when sound nickel deposits of moderate stress and high ductility are required.

Notes on

NICKEL PLATING FROM A FLUOBORATE BATH

E. J. ROEHL* AND W. A. WESLEY†

HISTORICAL

In spite of the fact that fluoborates have been employed sporadically as an ingredient in nickel plating baths since the beginning of the century, detailed information is lacking on the behavior of electrolytes having nickel fluoborate as the major source of nickel ions. The purpose of the present brief study was to learn the salient characteristics of such an electrolyte used as a nickel plating bath and to determine the quality of deposits made from it.

A sound, malleable nickel deposit 5/16 inch (8 mm) thick was made by Kern[1] in 1908 from a cold neutral solution containing only nickel fluoborate equivalent to a nickel content of 8 per cent by weight (approx. 100 g/l Ni). A few years later Hollard recommended a nickel fluoborate bath for use in electrotyping[2]. He made up his bath by neutralizing 65 g boric acid and 142 g hydrofluoric acid (45 per cent strength) per liter of water with excess nickel carbonate. Watts[2] confirmed the suitability of the nickel fluoborate electrolyte for thick deposits but gave no additional data. In 1920 F. J. Liscombe published the results of a few experiments[3] in which he employed solutions of nickel fluoborate and nickel ammonium fluoborate, but he obtained only fairly satisfactory deposits.

W. Blum[3] described experiments involving the preparation of relatively thick nickel deposits from a cold sulfate bath containing nickel fluoborate and boric acid. These led to commercial use of the bath in the electrolytic reproduction of engraved printing plates at the Bureau of Engraving and Printing. Blum had rejected electrolytes containing high percentages of fluoborate and the all-fluoborate electrolyte in preliminary experiments which showed that the deposits were "less satisfactory" than those from a solution which was 1.8 *N* in nickel sulfate, 0.2 *N* in nickel fluoride, and 0.5 *M* in boric acid. Like many other workers Blum demonstrated the very high buffering capacity of fluoride-boric acid solutions, but it is not clear just what benefits, other than ease of control of

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TABLE I. ELECTROLYTE COMPOSITIONS AND OPERATING CONDITIONS

Component or Condition	Bath Type: Watts		Chloride		Fluoborate	
	oz/gal	g/l	oz/gal	g/l	oz/gal	g/l
Nickel sulfate	40	300	..	...	..	...
Nickel chloride	6	45	40	300	..	...
Nickel fluoborate	..	..	..	...	40	300
Nickel	10	75	10	75	10	75
Boric acid	4	30	4	30	4	30
Impurities:	ppm		ppm		ppm	
Cu, max.	10		10		6.4†	
Fe, max.	6		10		20. †	
Pb, max.	1		1		0.9†	
Zn	2		2		13.2†	
*p*H, electrometric	2.0		2.0		2.7–3.5*	
Temperature, ° F	130		130		130	

*Colorimetric. This range recommended by fluoborate producers.
†By analysis of freshly purified bath.

*p*H, this property confers. The nickel deposits were harder than those from a cold Watts bath and showed tensile strengths from 100,000 to 133,000 psi (70 to 93.5 kg/mm²) with from 2.4 to 4.8 per cent elongation in 2 inches (51 mm).

Electrolytes

While the chemistry of aqueous fluoborate solutions is not well understood it is sufficient for operation and control of the plating bath simply to assume that in the presence of excess boric acid the principal ingredient is $Ni(BF_4)_2$. This material is available commercially in the form of a concentrated solution containing 44 per cent nickel fluoborate plus about 3.5 per cent excess boric acid. Fluoboric acid is used for *p*H adjustment.

The concentrated nickel fluoborate solution was diluted to give an electrolyte containing 10 oz/gal (75 g/l) nickel (Ni), and then boric acid was added to provide a concentration of 4 oz/gal (30 g/l) free H_3BO_3. The resulting electrolyte was so well buffered that a high-*p*H purification could not be employed; the bath was therefore treated with activated carbon, worked for several days at 2–5 asf (0.2–0.5 amp/dm²), again treated with activated carbon, and finally worked for several days at 50 asf (5.4 amp/dm²). Since the glass electrode cannot be employed in this bath, *p*H measurements were made colorimetrically.

The Watts-type and chloride baths were taken from large tanks of these solutions in which the nickel, chloride and boric acid contents were maintained within ± 10 per cent of the nominal values shown in Table I while the metallic impurities were maintained below the limits shown in that table.

Resistivity.—An estimate of the resistivity of the fluoborate bath was made from measurements in a rubber-lined cell in the manner suggested by Haring[4]. An anode and cathode of electrolytic nickel filled the cross-section at both ends of the cell and two pieces of nickel-wire gauze were inserted between the electrodes to form the three equal compartments in the cell.

The voltage-drop measurements observed in the same cell with all three nickel plating baths of Table I gave a value of 5.5 ohm-cm for the specific resistivity of the fluoborate bath based upon 11.02 and 5.49 ohm-cm for the known resistivities[5] of the Watts and chloride baths, respectively, all at 130 ± 1° F (54.5 ± 0.5° C). The fluoborate electrolyte can therefore be considered a high-conductivity nickel plating bath, comparable in this respect to the chloride electrolyte.

Electrode Efficiencies.—Electrode efficiencies were measured at various current densities with the aid of a copper coulometer. The latter contained two liters of electrolyte and was equipped with copper cathodes of such a size that the current density was within the limits of 0.2 and 2.0 amp/dm² in all runs.

For the anode-efficiency tests nickel electrodes 1 inch wide were cut from depolarized nickel or from pure electrolytic cathode nickel. Two anodes were mounted on opposite sides of a common cathode and pressed against the wall of the plating cell. Each anode was immersed to a depth of 3¾ inches (95 mm) so that the total effective immersed anode area was 0.052 sq.ft (0.48 dm²). The *p*H of the fluoborate electrolyte was maintained between 2.7 and 2.8 and its temperature at 130 ± 1° F (54.5 ± 0.5° C). Under

TABLE II. CATHODE EFFICIENCY
Temperature: 130 ± 1° F (54.5 ± 0.5° C)

Cathode Current Density		Cathode Current Efficiency, per cent				
		Fluoborate Bath at *p*H 2.7–2.8*			Watts Bath at *p*H 2.0†	Chloride Bath at *p*H 2.0†
asf	amp/dm²	Run 1	Run 2	Average		
10	1.1	90.6	90.9	90.8	93	98.5
25	2.7	94.8	95.3	95.1	96	98.7
50	5.4	95.4	95.2	95.3	97	99.2

*Colorimetric.
†From Wesley and Roehl[5].

these conditions the measured anode efficiencies were independent of the current density, which was varied from 25 to 100 asf (2.7–10.8 amp/dm²). The range was from 95–102 per cent efficiency except in experiments with electrolytic nickel anodes at the highest current density of 100 asf (10.8 amp/dm²). In the latter case results were more erratic with occurrence of initial periods of passivity and average anode efficiences as low as 75 per cent.

Better control was indicated in the cathode current efficiency tests which were performed with individual cylindrical copper cathodes cut from a ¼-inch (6-mm) rod and mounted between two of the nickel anodes. The immersed cathode area was 0.03 sq.ft (0.28 dm²). The copper coulometer was used in these tests also. Results are presented in Table II and show that the cathode current efficiency in the fluoborate bath lies somewhat below that of the low-*p*H Watts bath, which in turn is lower than that of the chloride bath[5]. Since the values lie above 90 per cent even at a low current density, the cathode current efficiency of the fluoborate bath can be considered satisfactory.

Deposit Characteristics

Mechanical Properties.—In order to measure some of the mechanical properties of nickel made from the fluoborate bath, a deposit 0.035 inch (0.89 mm) thick was prepared on a stainless-steel cathode, from which it was readily stripped. From this deposit were cut six miniature tension-test specimens 6 inches (152 mm) long by ½ inch (12.7 mm) wide with a reduced section 2 inches (51 mm) long by ¼ inch (6.3 mm) wide. In preparing this thick deposit the plating conditions were temperature 130° F (54° C), *p*H 2.6–2.7, and current density 30 asf (3.2 amp/dm²). It was necessary to use an anti-pitting reagent, so hydrogen peroxide was added in a minimal amount. Only slow agitation by an air stream sufficient to prevent stratification was employed.

The results of tensile and hardness tests are presented in Table III. They indicate that the mechanical properties of nickel from the fluoborate bath are good, particularly the ductility which is fully as high as that of nickel from the Watts bath operated under optimum conditions for ductile deposits[6].

Adhesion.—To determine whether any films tend to form on a steel or copper base which might interfere with good adhesion of nickel deposits, quantitative adhesion tests were made by a method devised by B. B. Knapp[7]. Two sheets of SAE 1010 steel were degreased, anodically etched at 200 asf (21.5 amp/dm²) for 5 minutes in 25 per cent (by weight) sulfuric acid solution at room temperature, then were coated with a nickel deposit 0.04 inch (1 mm) thick from the fluoborate bath at 50 asf (5.4 amp/dm²). Two additional pieces were cleaned and etched as above, then were given a flash coating of copper from a cyanide bath, followed by a 0.001-inch (25-μ) deposit from an acid copper bath. They were then bright dipped, heavily plated with nickel from the fluoborate bath at 50 asf. From these four pieces were cut four adhesion test specimens of the form prescribed by Knapp[7]. These were broken in a tensile-testing machine with a special jig which subjects the bond between the steel and the coating metals to a stress which is largely tensile in nature in a direction perpendicular to the interface. The results in Table IV show that the adhesion of nickel as plated from the fluoborate bath was high enough that the test pieces did not fail at the bond but broke in the nickel or copper layer itself.

In preparing the heavy nickel deposits no guards were used to shield the edges, which gave an opportunity to observe the tendency to form trees. This tendency was definitely less than that of the Watts bath, but the nodules were of the same type and unlike the smooth, rounded edges building up in a chloride bath.

Effect of Metallic Impurities.—An attempt was made by means of Hull Cell tests[8] to estimate the relative sensitivities of the three plating baths to contamination by inorganic impurities. The cell was of standard dimensions for the 250-ml size and a current of 2.0 amperes was applied for 10 minutes in each test.

TABLE III. MECHANICAL PROPERTIES

Property	Run 1	Run 2	Run 3	Average
Tensile Strength, psi				
As plated	56,000	55,000	55,500	55,500 (39.0 kg/mm²)
Annealed*	51,500	52,500	50,500	51,500 (36.2 kg/mm²)
Elongation, per cent				
As plated, in 1 inch (25 mm)	42	..	38	40
As plated, in 2 inches (51 mm)	32	..	31	32
Annealed*, in 1 inch (25 mm)	55	55	52	54
Annealed*, in 2 inches (51 mm)	45	46	45	45
Vickers Hardness†				
As plated	131	127	126	128
Annealed*	64.5	70.7	63.6	66

*Annealed for 15 minutes in hydrogen gas at 1400° F (760° C).

†10 kg load, diamond pyramid indentor. Measurements were made on outer or last-plated surface after it had been smoothed with emery paper.

TABLE IV. ADHESION OF NICKEL FROM FLUOBORATE BATH TO STEEL AND COPPER

Basis Metal	Adhesion		Location of Break
	psi	kg/mm²	
SAE 1010 Steel	56,000	39.4	In nickel layer
SAE 1010 Steel	54,000	38.0	In nickel layer
Steel, copper-coated	8,000	5.6	In copper layer
Steel, copper-coated	9,000	6.3	In copper layer

Steel cathodes were used. The temperature of the electrolyte was maintained at 130° F (54° C) by partly immersing the cell in a thermostatically controlled bath.

Starting with the Watts bath and adding increments of a given metal salt, Hull Cell plates were made and compared to detect changes in appearance or plating range caused by the added impurity. It was amazing to find that neither ferrous iron in amounts up to 1.0 g/l, lead to 0.05 g/l, zinc to 1.2 g/l or aluminum to 0.12 g/l produced significant changes in appearance over the plating range of 4–100 asf (0.4–10.8 amp/dm²) represented by each plate. With copper additions some small dark spots appeared in areas representing current densities above 40 asf (4.3 amp/dm²) when the copper content was raised to 0.5 g/l.

Observations were made with the chloride bath with only the maximum quantities of impurities mentioned above. The results were similar to those obtained in the Watts bath except that the iron addition caused considerable pitting.

Deposits from the fluoborate bath were lighter in color than the chloride deposits in regions of comparable current densities but were matte in texture throughout. They were not as white as the corresponding Watts-bath deposits. When zinc was added to the extent of 1.2 g/l to the fluoborate bath there was a brightening effect but no decrease in the plating range was apparent. Addition of 1.0 g/l iron introduced pitting while copper in the amount of 0.5 g/l did not cause formation of dark spots but did cause pitting at all current densities.

The impurity tolerance limits for nickel baths are generally considered to lie in the neighborhood of 0.1–0.2 g/l for iron, 0.01–0.05 g/l for copper, 0.05 g/l for zinc, 0.002 g/l for lead and 0.05 g/l for aluminum. These values are considerably lower than the maximum concentrations employed in the Hull Cell tests. It is evident that such tests are not critical enough to evaluate effects of contamination of grey nickel baths which should better be sought in changes in hardness, ductility, stress and the like.

Stress.—The procedure followed in making residual stress determinations was identical with that of Phillips and Clifton[9] except that the spring-steel test strips were 6 by ½ by 0.0175 inch (152 by 12.7 by 0.45 mm) in dimensions. Deposit thickness was

TABLE V. EFFECT OF IRON CONTAMINATION OF BATH ON RESIDUAL CONTRACTILE STRESS IN NICKEL DEPOSITS

Cathode current density: 50 asf (5.4 amp/dm²)
Deposit thickness: 0.001 inch (25 μ)

Ferrous Iron Added	Stress					
	Watts Bath		Chloride Bath		Fluoborate Bath	
g/l	psi	kg/mm²	psi	kg/mm²	psi	kg/mm²
None	23,000	16	39,000	27	15,000	11
0.15	24,000	17	42,000	30	17,000	12
0.3	27,000	19	46,000	32	20,000	14
0.4	29,000	20	50,000	35	22,000	15
Ferric Iron						
None	20,000	14	.....	..	.....	..
0.15	24,000	17	.....	..	.....	..
0.3	27,000	19	.....	..	.....	..
0.4	33,000	23	.....	..	.....	..

standardized at 0.001 inch (25 μ). Test pieces were constrained from bending during plating and were shielded for uniform current distribution by being mounted in a holder similar to that of Phillips and Clifton. Measurement of curvature of the strip after plating was done with a dial indicator having two dial gauges, one serving to measure the curvature on the concave side, the other on the convex. The readings of the two gauges always checked within 10 per cent, the average being used in computing the stress. This procedure falls under Method II as classified by Brenner and Senderoff[11], hence their equation 6 was used in calculating the stress values shown in Table V:

$$S = \frac{E\,(t+d)^3}{3rd\,(2t+d)} = \frac{E\,(t+d)^3}{3d\,(2t+d)} \times \frac{8Z}{L^2}$$

where S is the stress in the plated layer, E is the modulus of elasticity of the basis metal and nickel deposit, t is the thickness of the basis metal, d is the thickness of coating, Z is the deflection of the strip due to plating, r is the radius of curvature of the strip after release, and L is the length of the test section between knife edges of the stress gage.

Substituting the actual values used in this work we have for *each 0.001-inch* deflection:

$$S = \frac{30 \times 10^6\,(.0175 + .0010)^3\,8 \times 10^{-3}}{3 \times .001\,(.035 + .001)^2} = 1563\ psi$$

The results of stress measurements made on deposits from the three plating baths to which various amounts of ferrous or ferric sulfate were added are given in Table V. The data on the iron-free solutions are in good agreement with the results of Soderberg and Graham[10]. They show that the fluoborate bath yields deposits of the lowest contractile stress of the three baths, the values being only about two-th rds of those for the Watts bath deposits. Contamination by iron increased the stress in nickel deposits from all three baths, and the magnitude of this effect was about the same in all cases.

Miscellaneous Comments

The high ductility and low stress of deposits from the fluoborate bath, together with its well known high buffering capacity and its good conductivity, make the bath attractive for rapid plating of heavy deposits. The bath requires an anti-pitting agent. Hydrogen peroxide can be used as well as some wetting agents. According to the suppliers, this electrolyte attacks high-silicon cast iron and lead. Pyrex glass, carbon, rubber linings and high nickel-chromium-iron alloys of the type containing Ni 25 per cent, Cr 20 per cent and Mo 3 per cent can be used successfully. No filter aid of the silica type can be used, but paper pulp is satisfactory. Vinyon-yarn anode bags and filter cloths are said to be satisfactory.

Conclusions

1. A good general-purpose fluoborate bath is one containing 40 oz/gal (300 g/l) nickel fluoborate and 4 oz/gal (30 g/l) excess boric acid operated at *p*H 2.7–3.5 (colorimetric) and a temperature of 130° F (54° C).

2. Deposits from this bath show excellent mechanical properties. At 50 asf (5.4 amp/dm²) the product showed a hardness of 130 Vickers, a tensile strength of 55,000 psi (39 kg/mm²) and very high ductility as indicated by an elongation of 32 per cent in 2 inches (51 mm).

3. Anode and cathode efficiencies at current densi-

(*Continued on page 171*)

leaders in the industry xxi

C. L. faust

Charles L. Faust was born on November 8, 1906, in St. Louis, Mo., where he spent most of his first twenty-four years. During this time there were periods of residence elsewhere, including "hill billy country" in Southern Missouri for three years.

A liking for painting and sketching led to an early intention to become an illustrator or commercial artist. However, after he had enrolled in freshman chemistry at St. Louis University, art became relegated to the status of an avocation.

In 1926 he began study of chemical engineering at Washington University, from which an M.S. degree was received in 1931. There were periods of employment as a rodman with the Wabash Railroad Company, as exchange repairman with the Southwestern Bell Telephone Company and as an installer with the Western Electric Company.

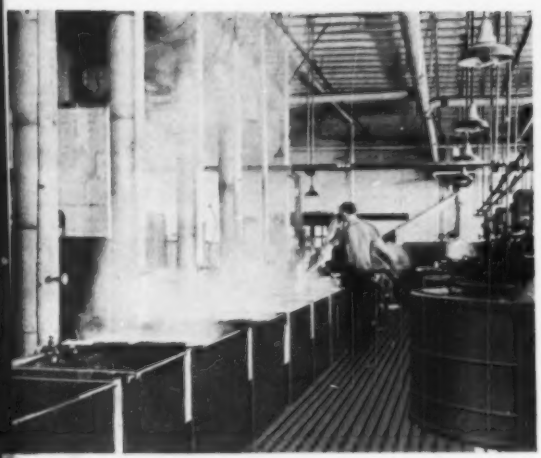
During the year 1930–1931 Dr. Faust was Industrial Research Fellow at Washington University. In 1931 he was awarded a graduate assistantship at the University of Minnesota where he received his Ph.D. degree in chemical engineering. He joined the staff of Battelle Memorial Institute as a research engineer in 1934. At the present time he is the supervisor of its Electrochemical Engineering Division, with activities related to metal finishing, pickling, electroforming, electrowinning, electrorefining, waste disposal, and certain process engineering research and development.

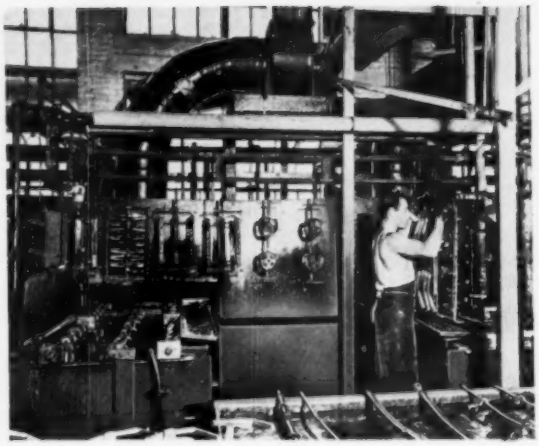
It was at Washington University that Dr. Faust's electroplating activities began with a study of zinc-cadmium alloy plating for his Bachelor's Thesis. From then on he has participated in alloy plating research continuously and has pioneered in the application of alloy plating to bearing manufacture. He is probably best known for his work in electropolishing, being among the first to develop commercial applications.

Dr. Faust joined the American Electroplaters' Society in 1939, and in 1942 was appointed an Associate Editor of The Monthly Review, an office he held until the end of 1949, when he reluctantly resigned because of pressure of other duties. He is very active in the Electrochemical Society, of which he is Vice-President, a two-term member of its Board of Directors, and member of its Ways and Means and Publication Committees. He is also a member of the American Chemical Society and the Electrodepositors' Technical Society of England, and is a Professional Engineer. He holds memberships in Sigma Xi, Tau Beta Pi, Pi Mu Epsilon, and Phi Lambda Upsilon, honorary scientific, engineering, mathematic, and chemical societies respectively, and in Alpha Chi Sigma, a professional chemical fraternity. His name is found in American Men of Science and in Who's Who in Engineering.

Dr. Faust became a Boy Scout just a few years after the organization of the movement and reached the Eagle rank. He has served twelve years as an adult leader in scouting and cubbing, both of which are hobbies that today afford an opportunity to work with his two sons. He also has a daughter, who with his wife completes the family roster. Other activities are bowling, swimming, photography, and "community" politics.

Dr. Faust is the author or co-author of over 40 technical articles, two chapters in books and over 30 U. S. and foreign patents. He is a popular speaker and has addressed many of the A. E. S. Branches in the East, some more than once, and a number of local sections of other societies.





modernizing a plating room

THIS picture story from the Old Greenwich, Conn., plant of the Electrolux Corporation, kindly prepared by Mr. Milton Hodges, Plant Engineer, illustrates the tremendous improvement which can be made by thorough-going modernization

HAND-OPERATED TANKS have been largely replaced by fullautomatic equipment, and parts are moved on overhead conveyors instead of trucks. Many of the exhaust ducts overhead have made way for vitreous-tile ducts underground.

The equipment now consists of six fullautomatic Udylite plating machines, including a zinc cyanide plating unit, not shown in the pictures, with its own complete cleaning cycle beginning with a 3–4 minute soak cleaning; one Hanson-Van Winkle-Munning fullautomatic chromium plating machine; and a line of five plating barrels with auxiliary equipment; all of which is used for regular production of vacuum-cleaner parts. In addition there are six small hand-operated tanks.

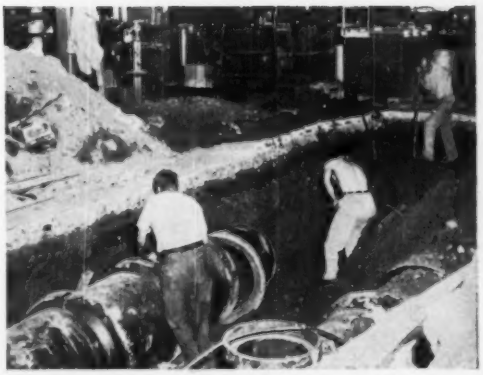
The plating room is operated on two shifts, and each week there are approximately one million pieces or sixty thousand plating racks of work put through the plating cycles.

Heat exchangers with automatic temperature controls are used wherever possible in place of heating coils. Both rectifiers and generators supply the DC current and are equipped with automatic voltage control. During the current water shortage, automatic controls have been installed on most rinse tanks and rinses are being recirculated wherever possible.

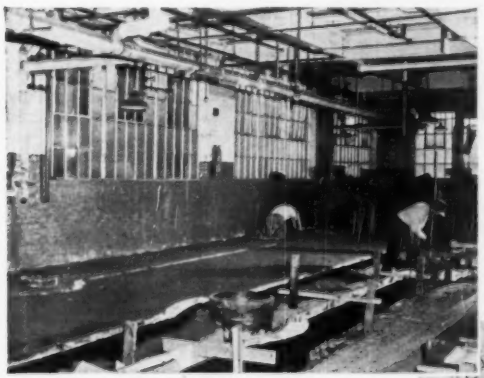
All plating-room waste water flows through a vitreous-tile drain to a treatment plant. Electrolux was one of the pioneer companies to install a plant to precipitate all metals and neutralize the plating-waste water. Originally this plant consisted of two 20,000-gallon treatment tanks. It has grown with the company and now consists of eight 20,000-gallon treatment tanks, all of redwood. The process employed, which is described in the 1949 *Proceedings* of the American Electroplaters' Society, was worked out with the cooperation of the Connecticut State Water Commission.

With one minor exception all parts to be nickel-chromium plated are cold-rolled-steel stampings. These are first polished with Nos. 180 and 240 emery and then finished with Grade N Lea greaseless composition. The bright nickel, which is about 0.0006 inch thick, is wiped on a buff before chromium plating to produce the desired high finish.

The long line of hand-operated cleaning, pickling and rinsing tanks and the old-fashioned rotary nickel plating machines shown in the picture at left were typical of the plating room before modernization. Chromium plating, center, was also done by hand. The view at the right shows a semiautomatic nickel plater in left foreground and individual-hoist barrels on the right. One can see how as production requirements grew, one piece of equipment was added after the other and fitted in as best could be done. Note the overhead exhaust ducts in these pictures.

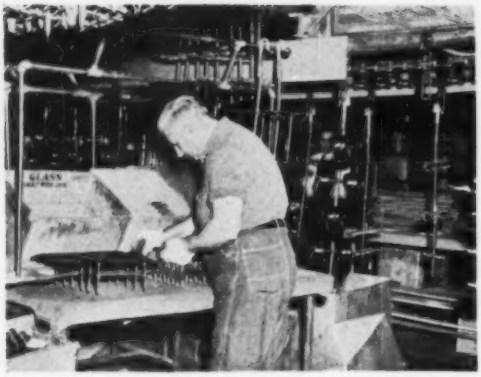


The modernization properly proceeded from the ground up with installation of vitreous-tile exhaust ducts and tees leading to the exhaust hoods, as well as of drain pipes of the same material.



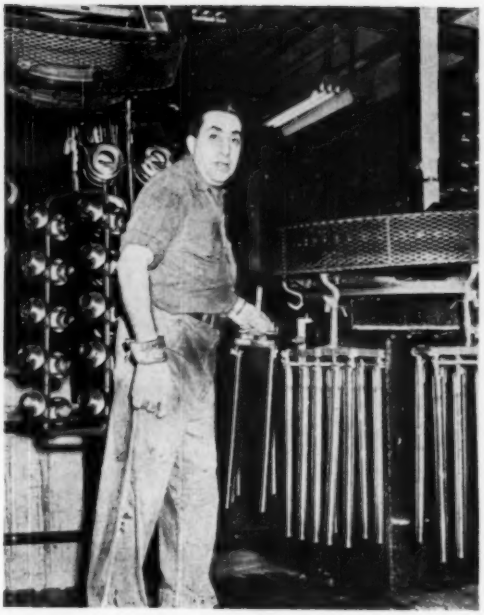
The concrete floor is being poured, with necessary gutters to the drains. Note openings to exhaust ducts.

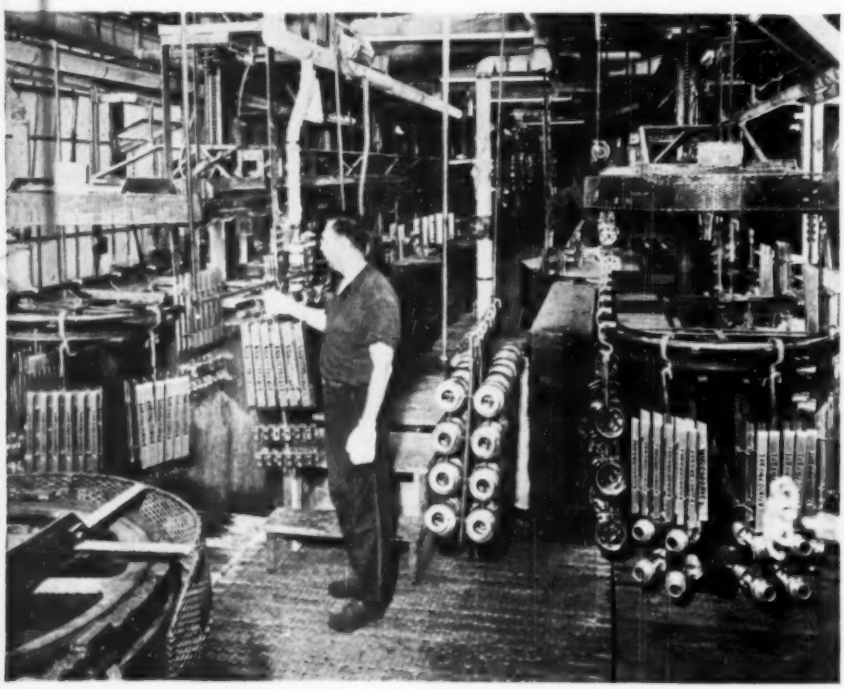
An already assembled Udylite fullautomatic plating machine has been unloaded from a flat-car and is being moved to the plating room on a truck-trailer.



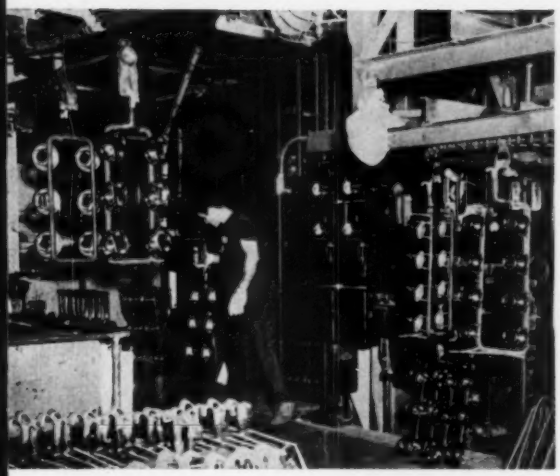
The heart of the new installation is the overhead conveyor shown on the cover. Above, alongside it is one of the racking benches where parts are racked and from which racks are carried to the automatics.

Racks with parts to be nickel plated are transferred from the overhead conveyor at right to the loading end of a Udylite automatic precleaning machine. The machine cycle is soak clean, rinse, electroclean, rinse, acid pickle, and rinse.





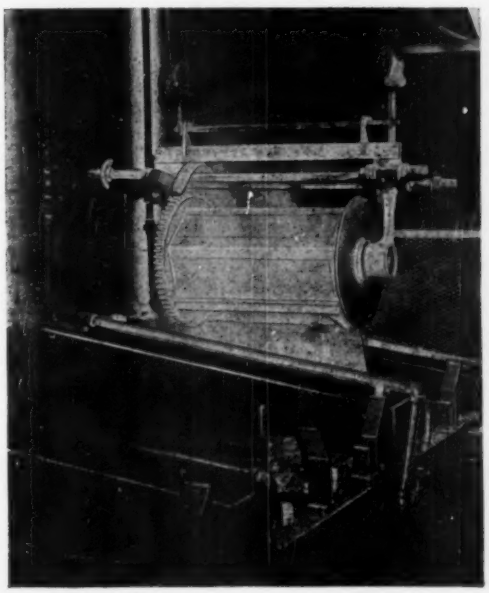
Cleaned parts on their racks are transferred from precleaning conveyor at lower left directly onto one of the Udylite automatic nickel plating machines. Here they are cleaned with direct and reverse current, rinsed, muriatic acid dipped, rinsed twice, bright nickel plated, passed through a drag-out tank, rinsed, hot rinsed, and oven dried. The same operator who loads and unloads the cleaning machine also transfers the racks with nickel plated parts back onto the overhead conveyor.



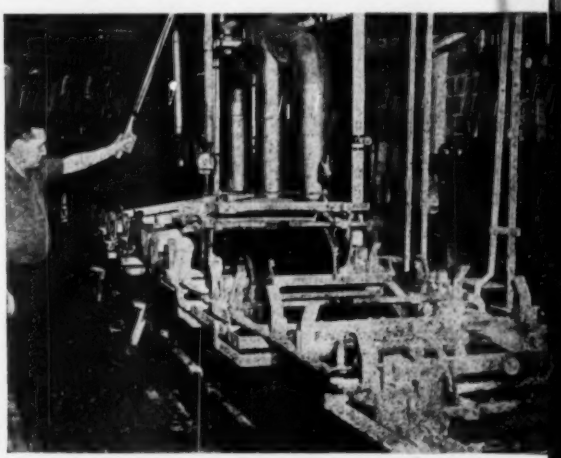
Nickel plated parts, after having been unracked, are color wiped with lime and reracked on special racks for chromium plating. Here the racks are transferred to and from Hanson-Van Winkle-Munning automatic chromium plating machine for mild direct-current alkali cleaning, rinsing, sulfuric acid dip, immersion and spray rinsing, and chromium plating. Following a dragout tank, they are cold rinsed three times, hot rinsed, and dried rapidly in an Optimus drier.

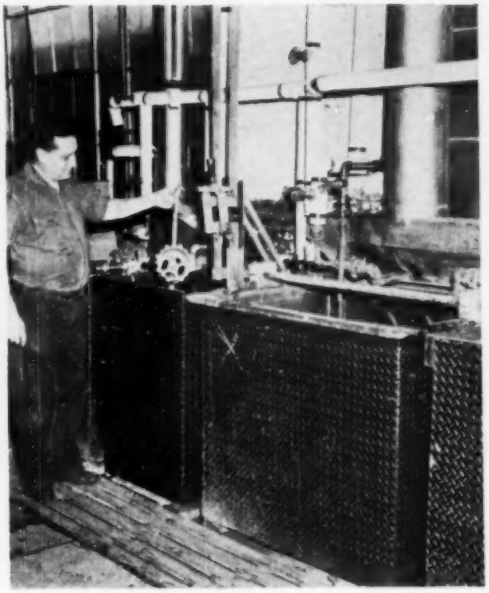
At this unloading station some racks are temporarily removed for unloading and others are unloaded without removal from the conveyor. From here the racks go back to the racking benches.

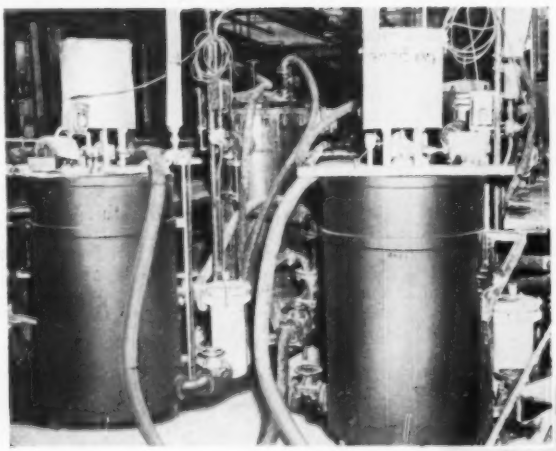
Small parts are handled in a unit built by Lasalco. They are placed in a monel-metal rotary cylinder and taken through a straight-line cleaning cycle—immersion cleaning, rinsing, muriatic acid dipping, and double rinsing—by means of overhead electric hoist.



The cleaning line continues with the barrel plating line, with a hopper-transfer stand in between. The plating line includes one nickel barrel with its rinse, two cadmium barrels with their rinse, two zinc barrels with their rinse, two air-operated hopper tanks with cold and hot water, and finally two Crown driers fed by the last hopper.







One of the few hand-operated units remaining is the 100-gallon set-up at top left for "hard" chromium plating of tools.

The small chromic acid anodizing installation for aluminum, above, is another hand-operated unit. It is powered by seven 6-volt rectifiers in series.

Solution maintenance is an important item. At left nickel solutions are filtered continuously with Industrial filters. Periodically they are also pumped to stand-by 5,000-gallon cylindrical tanks for bulk treatment with carbon, etc.

All plating, cleaning and pickling solutions are analyzed regularly in the modernized laboratory. In this corner is a Diggin Electroplating Control Table for plating tests. Hull Cell plates are made daily on each nickel plating solution to determine brightness and impurity contents. Additions of plating salts and percentage reject of critical parts are entered daily on control charts.

ELECTROCOLORING OF STAINLESS STEELS IN AQUEOUS SOLUTIONS

C. E. NAYLOR

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SO FAR AS CAN BE determined from the literature, there are three commercially useful methods of coloring stainless steels. One of these has been described by Clingan[1], who reported that stainless steel when immersed in molten sodium dichromate developed an intensely black film possessing considerable strength and elasticity, good resistance to abrasion, and improved resistance to corrosion under certain conditions. In another method[2,5], the stainless steel is sprayed with a solution (composition not given) and heated in a furnace to produce colors; available details of this process are very brief. A third method was developed and patented in 1940 by Batcheller[3], although an earlier reference to his work had appeared[2]. In this method, which uses aqueous solutions, the stainless steels are treated in solutions of sulfuric acid containing an oxidizing agent to produce a range of colors; variants of this method have also been described[4]. In this paper it is proposed to deal only with this type of process, i. e., treatment in modified sulfuric acid solutions.

Kiefer[5], in reviewing Batcheller's coloring processes, states that the colors are due to interference films on the stainless steel. He quotes Batcheller as saying that the processes may be divided into two groups, the first of which relates to the production of thin films giving rise to interference colors and the second to thicker films which are highly opaque. In a later paper, however, Batcheller[6] emphasizes that the colors produced are not interference colors. It is of interest to note that in experiments based on the rather meagre information contained in Batcheller's paper only interference-type colors could be produced.

A feature of practically all of the literature cited is that working instructions to enable the reader to color stainless steels for himself are somewhat inadequate.

The present paper is based on results of experiments carried out to determine, on the basis of available information, a practical method of coloring stainless steel. A number of methods were tried, and from these one, referred to as the electrolytic method, was selected as being the most practicable. This method is described in some detail in this paper. Fairly full details are also given of experiments with another method, because certain of the features of this method were rather strange and are as yet not fully explained.

Outline of Processes

The coloring of stainless steels in modified sulfuric acid solutions may be effected by three distinct methods, for sake of simplicity referred to as the electrolytic, the galvanic, and the immersion methods. From the results of experiments with these methods it was concluded that the electrolytic method showed distinct practical advantages over the other two and is to be preferred for commercial use.

The stainless steels, to be amenable to treatment by this process, must contain at least 7 per cent of chromium; the presence of other alloying elements merely serves to widen the range of colors it is possible to obtain.

The range of colors produced on a given stainless steel by use of any one of the above methods is basically the same. With 18–8 stainless steel the following colors are typical of those produced with increasing length of treatment up to 45 minutes: brown, blue, bronze, reddish brown, deep purple, and green. The generation of intense black films on straight chromium steels and on 12–12 nickel-chromium steels is possible by suitable treatment. To date the writer has not been able to produce black films on 18–8 type stainless steels. High-speed steels containing tungsten, molybdenum, etc., are also amenable to treatment.

The different processing treatments will now be described in detail.

The Electrolytic Method

This method of coloring stainless steels makes use of an external source of current applied to a cell consisting of the stainless-steel article as anode and a lead cathode, which for practical purposes can be the lead lining of the tank containing the solution. An anode current density of approximately 0.6 asf (0.06 amp/dm^2) was found to be suitable. Any great in-

TABLE I. TIME TO PRODUCE VARIOUS COLORS ON POLISHED AND ETCHED SURFACES

Color of Film	Time of Treatment, minutes	
	Mechanically Polished Surface	Anodically Etched Surface
Brown	5	5
Blue	10	15
Yellow	20	30
Reddish Purple	30	40
Deep Purple	40	80
Green	50	100

crease above this value tends to produce films of poorer quality and, in the extreme, to cause anodic etching of the surface. Voltages are in the range of 1.0–1.3 volt. A suitable arrangement for coloring stainless steel by the electrolytic method is shown in Fig. 1.

Processing Solutions.—Experimental work confirmed the statement of Batcheller[4] that satisfactory results are obtained in a sulfuric acid solution containing sodium dichromate, the latter conferring the necessary oxidizing and inhibiting properties on the solution. Other addition agents may be chosen from the sodium and potassium salts of chromic acid, as well as some of the salts of the vanadic acids. Nitric acid[4] has also been mentioned as a suitable addition agent; this was found, however, to be less satisfactory than any of the others tested.

A solution that gave good results consisted of 25 per cent by volume of sulfuric acid (sp. gr. 1.84) to which was added 8 oz of sodium dichromate per (U. S.) gallon of sulfuric acid mixture. The best operating temperatures for this solution were in the range of 158–185° F (70–95° C). The temperature did not appear to be critical, but some form of temperature control would be advisable for uniform results.

Color Control.—The greatest shortcoming of most metal-coloring processes is the difficulty of color matching, and the coloring of stainless steel is no exception. It is in this respect that the electrolytic method is superior to either the galvanic or the immersion methods.

One factor affecting color reproduction is lack of uniformity of surface finish. To quote an extreme case, this was clearly shown by treating anodically etched and mechanically polished samples under identical conditions. It was found that the coloring rate for the mechanically polished samples was approximately twice as high as that for the etched samples. (See Table I.) A method for producing uniform matte surfaces consists of anodic treatment in the recommended coloring solution at a current density of 72 asf (8 amp/dm²). The colors obtained after this treatment are perfectly uniform and possess considerable depth.

With the electrolytic method of treatment, the rate of color formation is dependent upon current density up to the point where anodic etching takes the place of coloring. This particular aspect of color control is important in that, where reproducibility of color is the objective, a given color on the stainless-steel article can be maintained from one batch to another only when the current density is held constant for the necessary time interval.

While solution temperature and composition are of lesser importance than other factors, both require some measure of control. Depletion of chemicals is due almost entirely to dragout, and solution composition may be adjusted by periodic addition of chemicals in amounts determined by analysis. Solution temperature should be controlled to within ± 5° F (± 3° C) by means of a suitable thermostat.

Agitation of the solution by gentle movement of the work rod, by stirring, or by mild air agitation leads to improved uniformity of color. This is found to be most beneficial with articles of intricate shape.

(*Continued on page 159*)

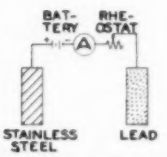


Fig. 1. Suitable arrangement for coloring stainless steel by the electrolytic method

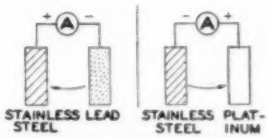


Fig. 2. Direction of current flow with different electrode couples

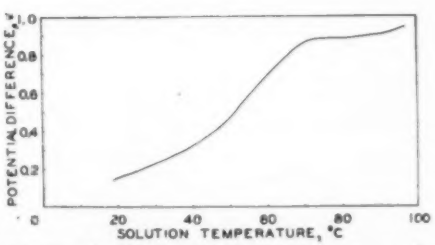
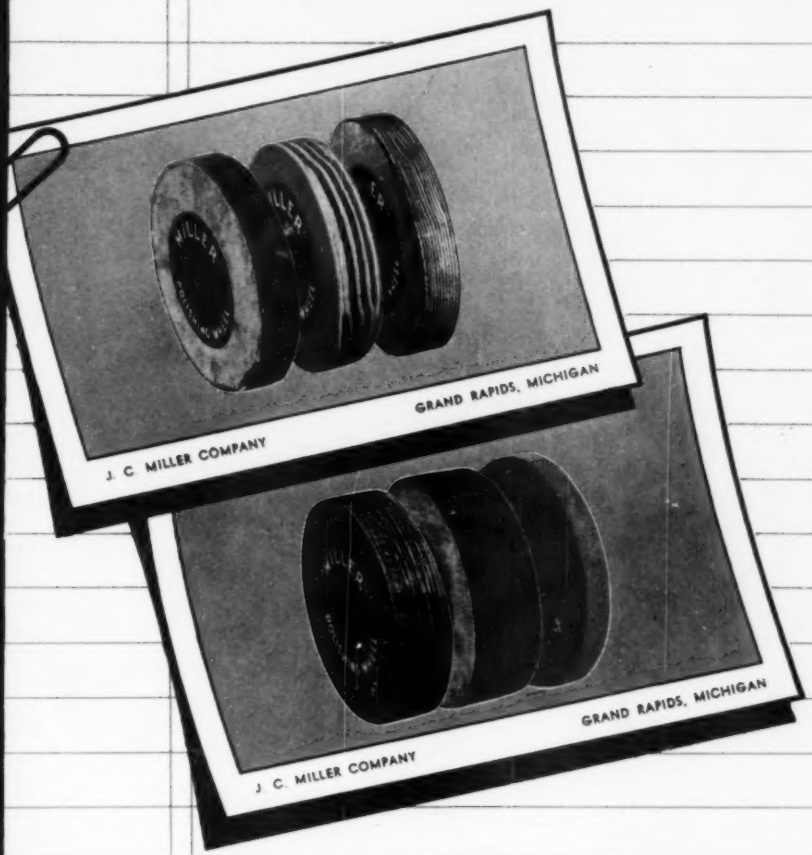


Fig. 3. Change in potential difference for a colored-stainless-steel/lead couple with solution temperature



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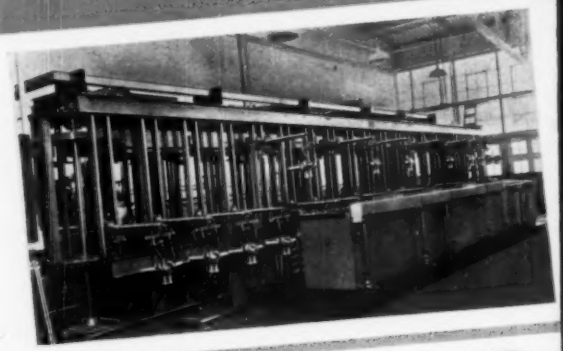

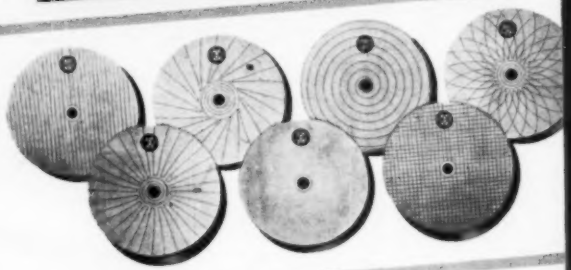

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The Immersion Method

With this method, the treatment consists of simple immersion of the stainless steel for 5–10 minutes in a solution preferably containing 50 per cent by volume of sulfuric acid (sp. gr. 1.84) and approximately 1.7 oz of sodium dichromate per gallon of sulfuric acid mixture.

The main disadvantage found with this method was the difficulty in matching colors. One color of the cycle tended to overlap the following color, and accurate treatment time was necessary for the reproduction of any one color. With more dilute solutions of sulfuric acid, the treatment times increased.

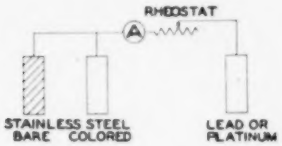

Fig. 4. Arrangement of electrodes in the circuit for coloring stainless steel by the galvanic method

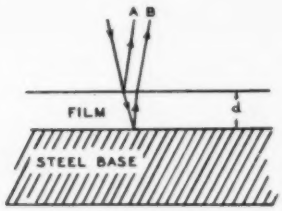

Fig. 5. Path of light rays through transparent film

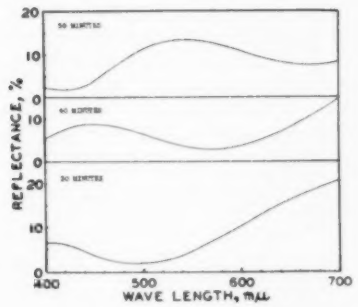

Fig. 6. Reflectance vs. wave length for colored oxide films as affected by treatment time

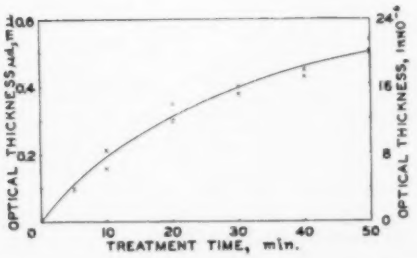

Fig. 7. Optical thickness of colored oxide films as affected by treatment time

The Galvanic Method

This method was outlined by Batcheller[4], who described a cell consisting of the lead lining of a tank as one electrode and the stainless-steel object to be colored as the other. He stated that coloring occurred without the use of externally applied current, and gave the following description of his process:

"Our typical tank assembly, in relation to its coloring solution, functions in the capacity of a voltaic cell. In such tank the alloy, irrespective of type, must always color oxidize as anode while the tank serves as cathode. All coloring solutions used in the various modifications of the process serve in the capacity of true electrolytes, with the process of continuous color oxidation and film build-up continuing in an orderly manner just so long as there is a steady current flow through the solution from the specimen to the tank lining. Accurate electrical measurements have determined this current flow to be in excess of 2 volts—1300 milliamperes at a solution temperature of 170° F".

In attempts to reproduce Batcheller's conditions using the solution of the electrolytic method for producing colors the writer was unable to confirm these findings. Instead he found that the stainless steel functioned as cathode (see Fig. 2), that the maximum potential difference obtainable between lead and stainless steel was of the order of 0.95 volt (see Fig. 3), and that the stainless steel would not color under these conditions.

In further experiments with this method, it was found that stainless steel in conjunction with lead could be colored providing an auxiliary electrode of previously colored stainless steel was attached to it either externally by a wire or by clamping together in solution (see Fig. 4). A current density of the order 0.06 asf (0.006 amp/dm²) was found to be adequate. It was also found that once color had started the auxiliary electrode could be removed without interrupting the coloring action. Further, the circuit could be broken and the stainless steel would produce its sequence of colors under purely immersion conditions. Normally an immersion treatment in this solution did not produce evidence of colored oxide films in less than one hour. With the galvanic method, colored oxide films were observed after 10–15 minutes. It should be noted here that solutions which contained dissolved metal resulting from their continued use were superior to new solutions, as they accelerated the rate of coloring and produced colors of greater depth. The explanation for this is not yet clear.

Incidental experiments with a stainless-steel/plati-

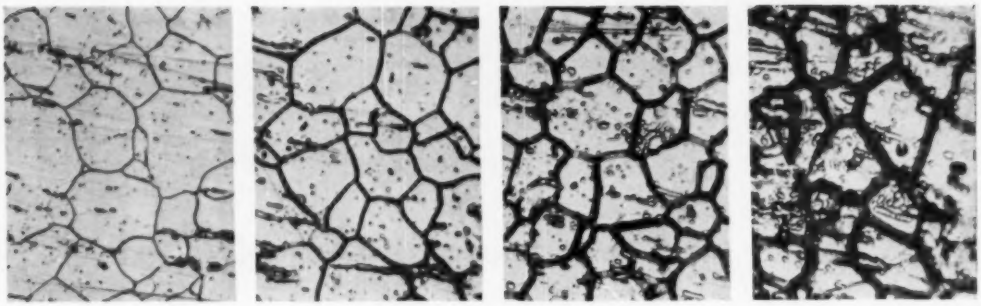

Fig. 8. Progressive effect of increased time of anodic etching of 18–8 stainless steel. Note widening of grain boundaries

num couple showed that the stainless steel colored without the use of an auxiliary colored-stainless-steel electrode. This was not altogether unexpected, since in this case the stainless steel functioned as an anode, a state conducive to the formation of oxide films (see Fig. 2).

Nature of the Colored Films

A series of differently colored panels was prepared for the purpose of determining the nature of the colored films. Graphs of the reflectance of the panels against wave length of incident light show definite maxima and minima which move towards the red end of the spectrum as the thickness of the film increases. This indicates that the colors are due to interference, a conclusion which is reached as follows:

In Fig. 5, if the thickness d is such that rays reflected from the surface of the film, A, are in phase with rays reflected from the underlying metal, B, maximum reflectance will take place. If, however, rays A are 180° out of phase with rays B, a minimum occurs.

Thus we have a maximum when

$$2\,\mu\,d = n\,\lambda$$

and a minimum when

$$2\,\mu\,d = (n + \tfrac{1}{2})\,\lambda$$

where μ = refractive index of film
n = an integer
λ = wave length of incident light.

From these equations it will be seen that as the thickness of the film increases both the maximum and the minimum reflectance will occur at a higher value of λ, assuming n is a constant. This is shown in practice and illustrated in the reflectance graphs in Fig. 6. The variation of color with different angles of viewing also indicates that the colors are due to interference. (This does not rule out the possibility of the existence of some body color in the film material.)

By substituting in the equations the values at which maxima and minima occur it is possible to obtain values for n and optical thickness d. The optical thicknesses of films produced on stainless-steel panels treated for various lengths of time are shown graphically in Fig. 7.

Uses of the Process

It is reported that the process has been used for stainless-steel articles (including castings) that are subject to particularly severe corrosive conditions.

It is also used for the production of name plates, instrument dials, scales, charts, etc., in conjunction with photographic stopoff techniques. The sequence of operations in this application is to produce the colored oxide film on the stainless steel, treat photographically to obtain the desired bichromate image, and etch electrolytically to remove unwanted color film. A suitable etching treatment consists of making the prepared stainless steel the anode in a 10–20 per cent potassium oxalate solution for a few seconds. Light rubbing with a cloth pad is all that is required to remove completely any residual film.

An application of this process which has apparently met with some success is to be found in the printing industry[7]. According to several reports, colored stainless-steel plates have been employed for lithographic work in place of the more common aluminum or zinc plates. It is claimed that the colored film has excellent ink-retaining properties and, in general, that the plates have considerably better wear resistance, which permits of longer production runs. Plates prepared in this way are first "grained", or etched, to give a uniformly rough surface. This can be done in the coloring tank by using a current density of 72 asf (8 amp/dm²).

The progress of anodic etching of mechanically polished 18–8 stainless steel is shown in a series of micrographs (see Fig. 8). It will be noted that grain boundaries and carbides have been attacked in preference to the austenitic matrix and, in particular, that the severity of attack at the grain boundaries increases with increased treatment time.

While the process finds many applications in the decorative finishing of stainless steels, several limita-

(*Continued on page 171*)

Electrodeposition of alloys of phosphorus and nickel or cobalt†

ABNER BRENNER, DWIGHT E. COUCH, AND EUGENIA KELLOGG WILLIAMS

National Bureau of Standards, Washington, D. C.

6. *Stress in Deposits*

It was of interest to measure the stress in the cobalt-phosphorus deposits because one objective of this study was to electroform deposits about 0.4 inch (1 cm) thick. The stress in the cobalt-phosphorus deposits was compared with the stress in cobalt deposits. The latter will be discussed first.

The stress, measured with a spiral contractometer[4], in the deposit from a cobalt chloride bath varied with the *p*H and temperature of the bath and in general was a little lower than the stress in nickel deposits obtained from an all-chloride bath. The stress in cobalt deposited at *p*H 3 and 167° F (75° C) was about 26,000 psi (1800 kg/cm²). The stress was highest in deposits made at *p*H 1–2 and lowest at *p*H 5. The stress in the cobalt deposits was not enough to crack deposits 0.04 inch (1 mm) thick, but occasionally deposits 0.20–0.32 inch (5–8 mm) thick would crack spontaneously. The explanation for this is not known.

The deposit from the Co-F cobalt bath had about the same stress as the deposit from a cobalt chloride bath, i. e., about 26,000 psi (1800 kg/cm²). On the addition of phosphorous acid to a concentration of about ¼ oz/gal (2 g/l) the stress increased to about 36,000 psi (2,500 kg/cm²). This stress caused no difficulty in making deposits 0.04 inch (1 mm) thick, but in electroforming heavier deposits the coating would sometimes crack spontaneously. On addition of several grams of saccharin per liter of the bath, the stress was reduced to about its original value. This effect of saccharin is not as pronounced in the cobalt-phosphorus bath as in ordinary nickel baths, in which the stress can be reduced to zero or even be made of the opposite sign, i. e., changed from a tensile to a compressive stress. Naphthalene trisulfonic acid, which is sometimes added to bright nickel baths to reduce stress, reduced the stress of the cobalt deposit by only about 20 per cent. It may be used in conjunction with the saccharin, but it has not been determined whether it affords any significant improvement.

TABLE IV. RATES OF ATTACK ON COBALT AND NICKEL, AND PHOSPHORUS-COBALT AND PHOSPHORUS-NICKEL ALLOYS BY NITRIC AND HYDROCHLORIC ACIDS

Metal	Weight Loss in mg/cm²–hour		
	As Plated	Heated to 400° C	Heated to 600° C
	In 1:1 Hydrochloric Acid		
Co	1.2	...	...
Co + 1%P	20.0	9.3	3.1
Co + 10%P	4.6	...	0.2
Ni	0.2	...	...
Ni + 2%P	1.9	1.5	1.1
Ni + 14%P	0.004	...	0.003
	In Air Above Conc. Hydrochloric cid		
Co	0.03	...	...
Co + 1%P	*	...	...
Co + 10%P	*	0.5	0.1
Ni	0.02	...	...
Ni + 2%P	1.6	...	1.3
Ni + 14%P	0.004	...	0.01
	In 1:1 Nitric Acid		
Co	1860	...	...
Co + 1%P	....	...	...
Co + 10%P	960	...	600
Ni	168	...	...
Ni + 2%P	234	...	90
Ni + 14%P	36	...	...

*These reacted very rapidly and fell apart during the 16-hour test run.

†Concluded from the January, 1950 issue

TABLE V. IDENTIFICATION OF PHOTOMICROGRAPHS OF COBALT AND PHOSPHORUS-COBALT ALLOYS IN FIG. 9

Letter	Bath Type	P in Deposit per cent	Heat Treatment Temperature of Deposit		Etchant
			°F	°C	
A	$CoCl_2$, no H_3PO_3	...	...	...	$H_2O + H_3PO_4$
B	$CoCl_2$, no H_3PO_3	...	750	400	$CrO_3 + H_2SO_4$
C	$CoCl_2$, no H_3PO_3	...	1110	600	$CrO_3 + H_2SO_4$
D	$CoCl_2$, no H_3PO_3	...	1470	800	$CrO_3 + H_2SO_4$
E	Co-F	2.2	....	...	$CrO_3 + H_2SO_4$
F	Co-F	2.2	750	400	$CrO_3 + H_2SO_4$
G	Co-F	2.2	1110	600	$CrO_3 + H_2SO_4$
H	Co-F	2.2	1470	800	$CrO_3 + H_2SO_4$
I	Co-H	10	....	...	$HNO_3 + CH_3COOH$*
J	Co-H	10	1470	800	$HNO_3 + CH_3COOH$*

*Electrolytic.

TABLE VI. IDENTIFICATION OF PHOTOMICROGRAPHS OF NICKEL AND NICKEL ALLOYS IN FIG. 10

Letter	Bath Type	P in Deposit per cent	Heat Treatment Temperature of Deposit		Etchant
			°F	°C	
A	Watts	....	....	....	$HNO_3 + CH_3COOH$
B	Watts	....	1830	1000	$HNO_3 + CH_3COOH$
C	Ni-L	2.3	....	....	Aqua regia
D	Ni-L	2.3	1470	800	$HNO_3 + CH_3COOH$*
E	Ni-H	13	....	....	$HNO_3 + CH_3COOH$*
F	Ni-H	13	750	400	$HNO_3 + CH_3COOH$*
G	Ni-H	13	1110	600	$HNO_3 + CH_3COOH$*
H	Ni-H	13	1470	800	$HNO_3 + CH_3COOH$*

*Electrolytic.

Although the stress in the deposits formed at room temperature was not much higher than in those made at 167° F (75° C), the former deposits tended to crack, probably because they were weaker and more brittle and hence could not withstand the stress developed in plating.

7. Chemical Properties

As cobalt and nickel phosphides that are prepared by thermal methods are not attacked by hydrochloric acid, it was expected that the phosphorus alloys would be less attacked by this acid than are the pure metals. This expectation was not entirely borne out (Table IV), as the low-phosphorus cobalt and nickel alloys (containing 1–2 per cent of phosphorus) were attacked by hydrochloric acid more rapidly than were the pure metals. However, the high-phosphorus nickel alloy (containing 10–15 per cent of phosphorus) was more resistant than pure nickel, and both the high-phosphorus cobalt and the high-phosphorus nickel alloys were more resistant to attack by nitric acid than the pure metals.

In the salt-spray test, the low-phosphorus cobalt alloy plated upon steel did not afford the steel as much protection as did pure cobalt coatings, and the nature of the corrosion was different. Rust spots formed on the cobalt-alloy coatings in the same manner that they form on standard nickel corrosion-test samples, and the deposits did not tarnish appreciably. Pure cobalt coatings, even if only 0.0002 inch (5 μ) thick, tarnished rapidly in the salt spray, forming a brown or dark purple film and no rust, or rust spots were formed. Bright nickel-phosphorus coatings (10–15 per cent phosphorus) behaved in the salt spray very much like ordinary nickel coatings. After two days, thin deposits (several μ thick) had numerous rust

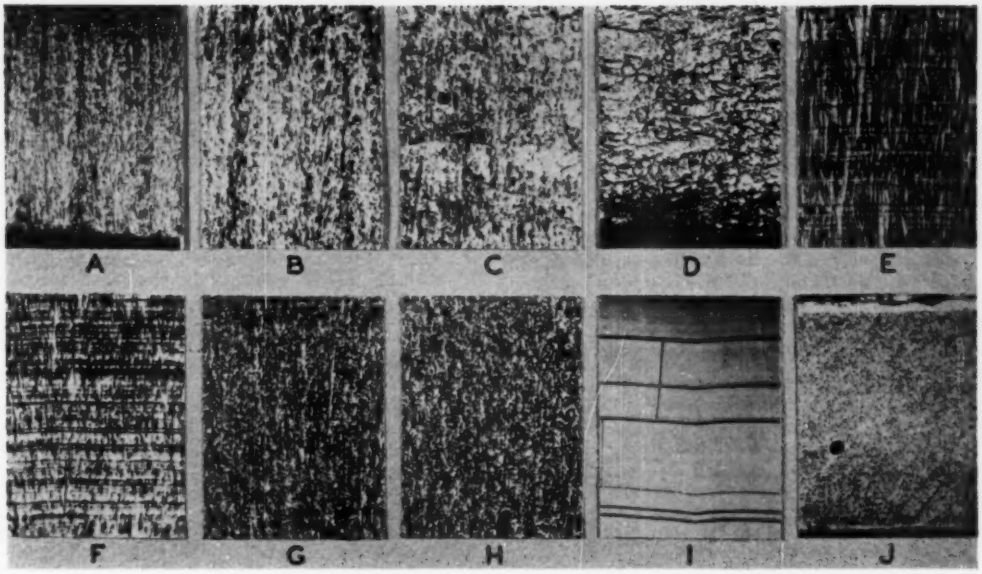

Fig. 10. Photomicrographs of nickel and phosphorus-nickel alloys. X250. For key to letters, see Table VI

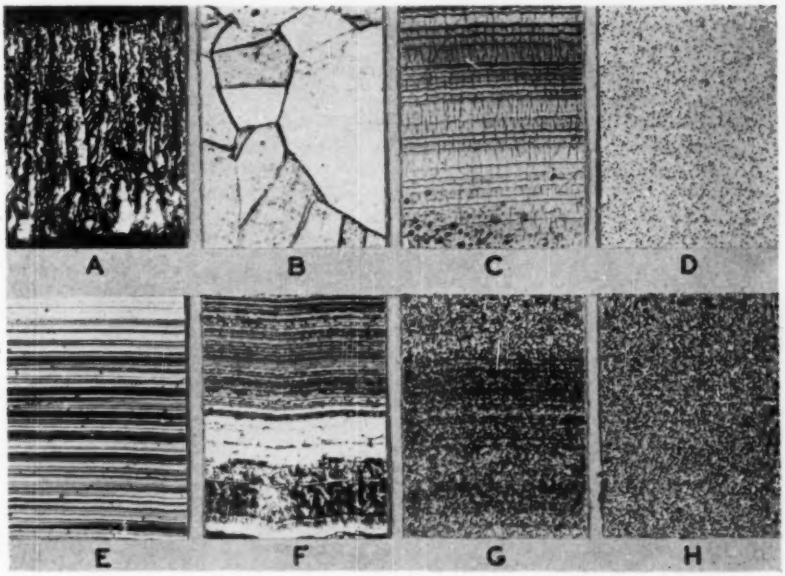

Fig. 9. Photomicrographs of cobalt and phosphorus-cobalt alloys. X250. For key to letters, see Table V

spots, but a deposit about 0.0014 inch (35 μ) thick did not show any rust spots after two weeks.

The phosphorus alloys, particularly the high-phosphorus cobalt alloy, turned black when treated for less than a minute with an oxidizing acid such as nitric acid, or when it was made anodic in the bath. When the black coating was not made too thick, it was hard and durable; and it may have some decorative value as well as affording protection against corrosion.

VI. Structure of Deposits

1. *Microstructure*

Photomicrographs of nickel and cobalt deposits are shown in Figs. 9 and 10. The low-phosphorus cobalt

deposits, Fig. 9E, from bath Co-F show a columnar structure superimposed upon laminations parallel to the basis metal. The crystals seem to be more clearly defined and larger than those in ordinary cobalt deposits, Fig. 9A, which is somewhat surprising in view of the greater hardness of the deposits. Usually the grain structure of a metal becomes much finer when another element is codeposited with it. The structure developed depended upon the etching reagent used. Good results were obtained on cobalt-phosphorus with a mixture of phosphoric acid and hydrogen peroxide and also with a mixture of chromic and sulfuric acids. However, the commonly used nitric-acetic acid mixtures caused irregular pitting of the deposits.

The high-phosphorus nickel and cobalt deposits were more resistant to etching. Immersion in a mixture of nitric and hydrochloric acids or electrolysis as anode in nitric acid brought out the microstructure satisfactorily. The Ni-L and Ni-H deposits (Figs. 10C and 10E) showed only a laminated structure which after heating to 1470° F (800° C) went over to a very fine grain structure. The Co-H deposit as plated (Fig. 9I) showed a laminated structure which appeared to be broken into a series of rectangles. These also were converted to a very fine grain structure by heating to 1470° F (800° C) (Fig. 9J).

2. *By X-ray Examination*

The structure of the nickel- and cobalt-phosphorus alloys was examined by X-ray diffraction by H. C. Vacher of the Metallurgy Division of this Bureau. A specimen of the low-phosphorus cobalt alloy, which contained 1 per cent of phosphorus and therefore probably about 5 per cent of the phosphide, showed only lines characteristic of cobalt. A specimen of the high-phosphorus nickel alloy yielded only one diffuse band, which indicated that the material was amorphous and therefore no information could be obtained about its composition. On heat treatment of the specimen at 1470° F (800° C), numerous lines appeared in addition to those of nickel, but it was not possible to determine whether these lines corresponded to any of the nickel phosphides which have been reported in the literature.

3. *By Chemical Examination*

An attempt was made to isolate the phosphide from the nickel deposits by direct solution in acid and by making the deposit anodic, but very little residue was left behind. A small amount of residue obtained from a cobalt specimen was found by analysis to be approximately Co_3P_2, but this may have been formed from a lower phosphide by the action of the acid[3].

A number of phosphides of nickel and cobalt have been reported in the literature. The existence of three phosphides of cobalt, Co_2P, CoP, and CoP_3, has been definitely established[4], and several others have been described, Co_3P_2, Co_4P_3, and Co_2P_3. About seven nickel phosphides have been fairly well characterized in the literature: Ni_3P, Ni_7P_3, Ni_5P_2, Ni_2P, $NiP_{0.611}$, NiP_2, and NiP_3[2,3,5,7,8]. The data on density in Fig. 7 would favor a compound having a phosphorus content corresponding to Ni_2P. This might also be Ni_5P_2, which has been isolated from nickel obtained by reduction with hypophosphite in aqueous solution[5,8]. On the basis of Ni_5P_2 a nickel-phosphorus alloy containing 15 per cent phosphorus would contain 85 per cent of phosphide. On the basis of Ni_2P, the alloy would consist entirely of nickel phosphide.

The equilibrium diagram[9,10] indicates that phosphorus is soluble in cobalt only to the extent of a few tenths of a per cent. This would indicate that the phosphorus alloys may be unstable solid solutions or mixtures of individual particles of metal and metal phosphides. The former hypothesis is favored, since the hardening of the metals on heating and the development of particles on heating as shown by the photomicrographs would indicate the precipitation of a second phase which must have been in a metastable solution in the metal.

VII. Possible Applications

The phosphorus-cobalt and nickel deposits should be useful wherever hardness is required; they could be considered as an alternative to chromium deposits. They would be particularly useful if the deposits are subjected to heat, as ordinary hard nickel will be permanently softened after heating to 1110° F (600° C) whereas the phosphorus alloys do not change appreciably in hardness.

The bright nickel-phosphorus coating could be used for protective or decorative plating, although it is not as white or as bright as commercial bright nickel. The phosphorus-nickel alloy can be chromium plated, but the finish is satin rather than bright. The bright nickel-phosphorus bath can be more easily controlled than other bright nickel baths because it contains no organic constituents and the brightening agent, phosphite, is used in large quantity. The phosphorus-cobalt deposit might also be used for decorative finishes since it can be plated bright, but a more unusual use would be the production of the black deposits mentioned above.

Acknowledgment

The authors express their appreciation to Virginia D. Morgan for taking the many hardness measurements that were required.

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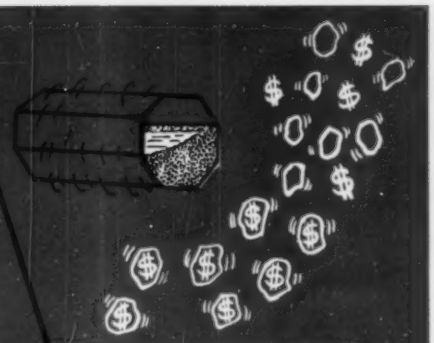
THE CASE OF THE ROLLING STONES THAT GATHER $



CASE HISTORY No. 100

KING-SEELEY CORPORATION, Ann Arbor, Mich.

Roto-Finish Process reduces finishing time 40%: A surface preparation before plating is essential for the satisfactory chrome finishing on a widespread variety of small parts such as manufactured by the King-Seeley Corporation. Rough and sharp edges must first be removed.

Previous to January 1946 this de-burring was performed as a hand operation at K-S. Separate handling for one operator was, at the maximum, 1,000 parts per hour. **After the Roto-Finish Process was introduced one man was able to handle an average of 12,000 parts in 5 hours.**

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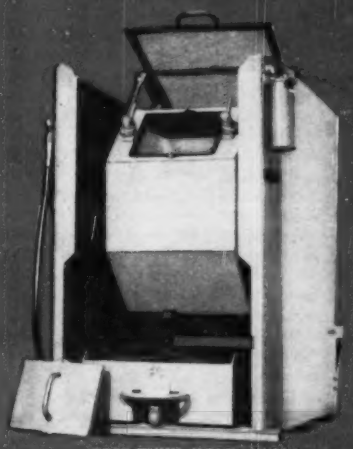

ROTO-FINISH MODEL CW22-1
Rubber lined cylinder. Note the safety screen and waterproof forward and reversing switch.

Make Us Prove It!

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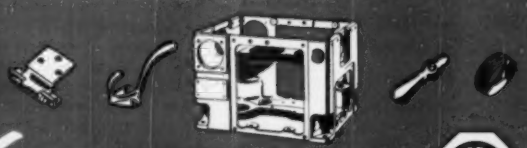
PRECISION FINISHED by ROTO-FINISH



Roto-Finish COMPANY KALAMAZOO, MICH.

ORIGINATORS OF THE ROTO-FINISH PROCESSES

ROTO FINISH

project no. 2

project director:
EARL J. SERFASS*

associates:
W. S. LEVINE*
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location:
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*AUTHORS

Determination of Impurities in Electroplating Solutions

XVII. TRACES OF LEAD IN COPPER PLATING BATHS

The purpose of this investigation was to develop a method for determining trace quantities of lead in copper plating baths which would be applicable even in the presence of comparatively large quantities of other impurities usually found in commercial plating baths: nickel, chromate chromium, ferric iron, calcium, aluminum, silver, silica, and chloride ions.

A method for determining traces of lead in nickel plating baths has been described previously by the authors[1]. The method involved complexing the nickel and any metallic impurities present in the bath with potassium cyanide and extracting the lead with a carbon tetrachloride solution of dithizone. The monocolor dithizone method was then used for making the final determination.

For a critical review of the methods that have been proposed and used for determining lead in plating baths and other materials, the reader is referred to the writers' earlier article[1].

Developmental Work

Since the desired method should be applicable to all types of copper plating baths including those having organic addition agents, it was decided to add perchloric acid to an aliquot of the bath and heat to fumes of the acid to destroy organic matter before proceeding with the analysis.

To determine how well the method developed for nickel plating baths would work on copper plating baths, the following tests were run. A standard copper plating bath containing 203 g/l $CuSO_4 \cdot 5H_2O$, 27 ml/l concentrated H_2SO_4, and 10 g/l sucrose was prepared and 1-ml aliquots transferred to each of six 50-ml beakers. The added sucrose was for the purpose of simulating the organic agents commonly added to baths. Two ml concentrated perchloric acid were added to each aliquot, and 50 micrograms of lead to beakers 2, 3, 5, and 6. Samples 1 and 4 were used as blanks. The samples were divided into two sets of three. One set was heated until all the organic matter had been oxidized and fumes of perchloric acid evolved. The other set received no additional treatment. Both sets were then analyzed for lead by making the solutions ammoniacal, complexing the copper with potassium cyanide, and extracting the lead with a carbon tetrachloride solution of dithizone. After the extracts had been stripped of excess dithizone, the transmittancies of the solutions were measured. It was found that those samples which had not been taken down to fumes of perchloric acid gave duplicable results and checked the readings obtained with equal quantities of lead in nickel plating baths. However, the samples that had been taken down to fumes of perchloric acid showed higher blanks, required a larger number of dithizone extractions, and gave erratic results. These conclusions were confirmed through

additional runs under identical conditions.

In order to locate the cause of these difficulties, a study was made of such factors as the amount of perchloric acid used, the length of time the mixture is allowed to evolve fumes after oxidation of the organic matter has been completed, and the time allowed to elapse between addition of the potassium cyanide and the extraction of the lead with dithizone.

It was found that if the solutions were allowed to fume for an appreciable length of time after the oxidation of the organic matter, the results obtained were erratic as were the number of dithizone extractions required to extract a given quantity of lead. Further experimentation showed that if the solutions were heated until the organic matter had *just* been oxidized, the results were more satisfactory. This moment is easily recognized because the solution turns black during the oxidation process and changes to the original copper blue when the oxidation is complete.

Another factor found to be of some importance was the time interval between the addition of the potassium cyanide and the extraction of the lead with dithizone. If this time interval was longer than an hour or so, erratic results were noted. However, if the samples are processed without allowing them to stand to this factor are eliminated.

If the samples were heated only until the organic matter had been oxidized and if the lead was extracted immediately following the potassium cyanide addition and the *p*H adjusted to around 8.8, the quantity of perchloric acid was not a critical factor in the determination. Tests were run using 1, 2, and 3 ml concentrated acid. It is, however, desirable to keep the volume used as small as possible because the greater the quantity used the more ammonium perchlorate is precipitated when the solution is made ammoniacal prior to the addition of potassium cyanide.

When the changes indicated above were incorporated into the procedure, good results were obtained with the pure copper bath of the composition described earlier in this paper. However, when a standard copper bath containing the kinds and quantities of ions—simulating bath impurities—shown in Table I was analyzed, high blanks were noted and an excessive number of dithizone extractions were again required to extract the lead. It was felt that this was due to the presence of the ferric iron and chromate chromium which tend to oxidize the dithizone and hence tend to increase the color intensity of the blank as well as to reduce the strength of the dithizone solution. To minimize this effect, 1 ml of a 1 per cent solution of hydroxylamine hydrochloride was added following the oxidation of the organic matter, the solution diluted to about 10 ml, and the mixture slowly boiled for 10 minutes to reduce the iron and chromic acid and to destroy the excess reducing agent. When this modification was introduced duplicable results were obtained, blanks were lower, and the maximum number of extractions required was three 5-ml quantities of the dithizone reagent to extract 50 micrograms of lead.

Preparation of Calibration Curve

Since the preliminary experiments had indicated that the procedure previously used for determining lead in nickel baths would give satisfactory results in the determination of lead in copper baths with the modifications outlined above, a calibration curve was prepared and the accuracy and precision of which the method was capable determined.

The calibration curve data were obtained by pipetting 1 ml of the standard copper bath described above into a series of six 50-ml beakers and then adding 0, 10, 20, 30, 40, and 50 micrograms of lead to successive beakers. The solution in the beaker to which no lead was added served as the blank for the set of runs. The samples were then treated according to the "Recommended Routine Procedure" which is described in detail below and the colorimeter readings—corrected for the blank—recorded. After three sets of samples had been run, the readings for each concentration were averaged and plotted against concentration to get the calibration curve shown in Fig. 1. The data are shown in Table II.

A Klett-Summerson colorimeter with the green No. 54 filter sold by the manufacturer was used in this investigation, but any other photoelectric colorimeter or spectrophotometer may be used. If the instrument has a wave-length selector, it should be set at 520 millimicrons, since the transmittancy of lead dithizonate in carbon tetrachloride shows a maximum at this wave length. This curve is shown in Fig. 2-A along with a curve showing the transmittancy curve of the Klett-Summerson No. 54 green filter (Fig. 2-B). Both curves were prepared from data obtained with a Beckman ultraviolet spectrophotometer.

The straight-line calibration curve shows that Bouguer-Beers' Law is followed by the lead dithizonate-carbon tetrachloride red-colored system over the concentration range investigated.

TABLE I. IMPURITIES ADDED TO SYNTHETIC BATH

Ion	Added as	Concentration g/l
CrO_3	CrO_3	0.2
Fe^{+3}	$Fe(NO_3)_3.6H_2O$	2.0
Ca^{+2}	$Ca(NO_3)_2.$ $4H_2O$	saturated
Al^{+3}	$Al_2(SO_4)_3.$ $18H_2O$	1.0
SiO_2	Na_2SiO_3	2.0
Ag^+	$AgNO_3$	0.5
Ni^{+2}	$NiSO_4.6H_2O$	1.0
Cl^-	NaCl	2.0

TABLE II. CALIBRATION CURVE DATA

Lead Added micrograms	Corrected Colorimeter Readings	Mean Reading
10	63	
10	65	63
10	62	
20	125	
20	127	127
20	129	
30	184	
30	190	189
30	195	
40	237	
40	243	241
40	241	
50	298	
50	298	302
50	310	

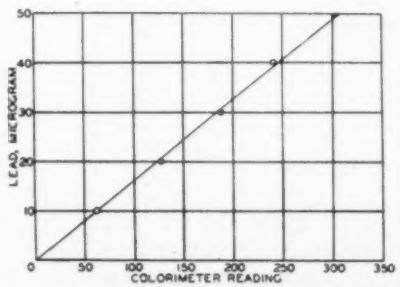

Fig. 1. Calibration curve for determination of lead in copper plating baths. Instrument used: Klett-Summerson colorimeter with green filter No. 54. Final volume of solution: 25 ml

TABLE III. ACCURACY ABD PRECISION DATA

Lead Added micrograms	Corrected Colorimeter Reading	Lead Found micrograms	Error per cent
10	69	11.4	+14.0
20	121	19.8	− 1.0
30	190	31.0	+ 3.3
40	232	38.0	− 5.0
50	296	48.0	− 4.0
50	298	48.0	− 4.0
50	300	49.0	− 2.0
50	311	50.5	+ 1.0
50	311	50.5	+ 1.0

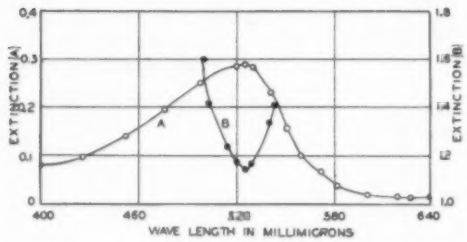

Fig. 2. Extinction vs wave length for (A) the lead dithizonate complex, (B) Klett-Summerson green filter No. 54

ACCURACY AND PRECISION OF METHOD

For these tests the synthetic impure copper bath, of the composition shown in Table I, was used. In the preparation of this bath the various salts described earlier were added to the synthetic copper bath, which was mixed well, heated almost to boiling, and allowed to stand overnight. Any undissolved material was discarded. The same procedure was followed as in the preparation of the calibration curve.

Table III shows the accuracy obtained on single runs and the precision that can be expected if the procedure is carefully duplicated. It is seen that the average accuracy of a single run can be expected to be about 3.6 per cent, while the average precision of a single run is about 2.4 per cent for 50 micrograms of lead. The accuracy for small amounts of lead—10 micrograms or so—does not seem too satisfactory.

The accuracy of this method was checked further by sending a check test sample to three different laboratories. The three laboratories that kindly consented to analyze the sample were E. I. duPont de Nemours & Company, Niagara Falls, N. Y.; Michigan Bumper Corporation, Grand Rapids, Mich.; and Bethlehem Steel Company, Bethlehem, Pa.

Check samples containing 50 ppm of lead were analyzed by these laboratories, and the results ranged from 10 to 0 ppm. This was probably due to the temperature changes during shipping causing precipitation of lead sulfate. Once lead sulfate has precipitated, it is extremely hard to make it redissolve.

It appeared that the best way to eliminate lead sulfate precipitation was to prepare the check samples from a copper cyanide plating bath, in which lead cyanide is soluble. Such samples were sent to the testing laboratories and along with them check samples for lead in a zinc cyanide bath.

The companies' reports of the lead contents of the copper cyanide and zinc cyanide baths are summarized in Table IV.

In one of the reports was mentioned that a precipitate had formed in the copper cyanide bath and not in the zinc cyanide bath. This was checked and found to be true. The copper cyanide check sample was then rechecked at Le-

TABLE IV. RESULTS OBTAINED BY COOPERATING LABORATORIES

Company	Lead Content Found in	
	CuCN Bath ppm	$Zn(CN)_2$ Bath ppm
A	20	23
B	16	24
C	10	22

high, and 10 ppm of lead were found where formerly there had been 20 ppm. The precipitate was taken on a filter, washed free of all bath, and dissolved in dilute nitric acid; it was found that the precipitate did contain lead. Therefore, lead is being precipitated in some form from the copper cyanide bath and not from the zinc cyanide bath.

The varying results of the lead in the copper cyanide bath could not be due to the method, as the methods for the copper cyanide and zinc cyanide baths are almost identical. It was decided that an insoluble cupro lead cyanide complex gradually forms, which precipitates out with time.

Since it was impossible to have the three cooperating laboratories analyze the check sample on the same day and since the results of the tests on the zinc cyanide solution all checked, it was decided to publish this method without further evaluation.

RECOMMENDED ROUTINE PROCEDURE

The following procedure is the one finally adopted for routine control work.

Reagents Required

1. Dithizone solution—0.01 per cent
Weigh out 100 mg dithizone in a 100-ml beaker. Break up all lumps and add 50 ml of carbon tetrachloride. Stir the mixture well and filter the solution through a Whatman No. 41 paper to remove insoluble material. Pour the filtrate through the filter several times before transferring the filtrate to a 150-ml Squibb-type separatory funnel. Add 50 ml of a 1:100 solution of ammonium hydroxide and shake for about one minute. After the liquids have separated, run the carbon tetrachloride layer into another separatory funnel containing 50 ml of the 1:100 NH_4OH and shake again. This second extraction will remove practically all the dithizone from the carbon tetrachloride layer. It should be colorless or have a light green color at this point. Discard the carbon tetrachloride layer and combine the two aqueous ammonia extracts. Wash these extracts four times with 10-ml portions of carbon tetrachloride. This will remove any diphenylthiocarbodiazone present. Now precipitate the dithizone with 2 ml of concentrated HCl and shake for a minute. Finally, extract the precipitated dithizone with 25-ml portions of carbon tetrachloride until the aqueous layer is colorless. Run these extracts into a pyrex 1-l volumetric flask and dilute to 1 liter with carbon tetrachloride. To protect the solution against oxidation, overlay it with a 5 per cent solution of pure hydroxyla-

mine hydrochloride, 1 centimeter thick. Keep the solution in a cool, dark place. It is stable for several months if kept in a refrigerator.

2. Potassium cyanide solution—5 per cent
   Dissolve 50 g of the fresh salt in sufficient water to make 1 liter of solution. Keep the solution in a pyrex flask or bottle.
3. Alkaline potassium cyanide solution
   Mix 10 ml of the 5 per cent KCN solution and 5 ml of concentrated NH_4OH and dilute to 1 liter.
4. Sodium tartrate solution—10 per cent
   Dissolve 100 g of the salt in distilled water and dilute to 1 liter
5. Concentrated ammonium hydroxide—C. P. grade
6. Tartaric acid—50 per cent
   Dissolve 25 g tartaric acid in distilled water and dilute to 50 ml.
7. Thymol blue indicator
   The indicator is used if a *p*H meter is not available.
8. Standard lead solution—10 mcg/ml
   Dissolve 100 mg pure test lead in 2 ml 1:1 nitric acid. The lead nitrate is transferred to a liter flask with thorough rinsing of the 50-ml beaker in which the lead has been dissolved. Add 5 ml glacial acetic acid, dilute to the mark with lead-free water, and mix well. Dilute 10 ml of this solution to 100 ml. The diluted solution contains 10 gamma lead per ml. Lead acetate or lead nitrate may be used for preparing the standard lead solution, but because of uncertainty in regard to the amount of moisture and water of crystallization that the salts may contain, it is best to use pure lead.
9. Perchloric acid—concentrated
10. Hydroxylamine hydrochloride—10 per cent
    Dissolve 10 g of the salt in distilled water and dilute to 100 ml.

Apparatus Required

1. *p*H meter or its equivalent
2. Two 60–100 ml short-stemmed Squibb-type separatory funnels
3. Pipettes and burettes
4. Klett-Summerson colorimeter with green filter No. 54 or any other photoelectric colorimeter

Procedure

A. Oxidation of Organic Material

1. Pipette 1 ml of the bath into a 50-ml beaker.
2. Add 1 ml concentrated perchloric acid, cover the beaker with a watch glass and boil until the black color due to the oxidation of the organic matter disappears.
3. Take the sample off the hot plate, cool, rinse off the watch glass, wash down the sides of the beaker, and add 1 ml of the 10 per cent hydroxylamine hydrochloride. The volume at this point should be about 10–12 ml.
4. Replace the covered beaker on the hot plate and boil gently for 10 minutes. If the volume goes down to about 5 ml, add a little distilled water. Avoid allowing the solution to boil for more than 10 minutes.
5. Cool, rinse off the watch glass, and add 10 ml 10 per cent sodium tartrate by pouring it down the sides of the beaker so as to wash them down with the reagent.
6. Add concentrated ammonium hydroxide until the solution turns dark blue in color.
7. Add 8 ml 5 per cent potassium cyanide to the solution immediately after having made it ammoniacal.
8. Measure the *p*H of the solution after mixing the solution well and adjust the *p*H to about 8.8 using either concentrated ammonium hydroxide or 50 per cent tartaric acid. After each addition of reagent, mix, and allow about 30 seconds to elapse before the *p*H is read. If thymol blue indicator is used, add 5 drops of it at this point and adjust the acidity until the solution is greenish in color.

B. Separation of the Lead

9. Transfer the contents of the beaker to a 150-ml Squibb-type separatory funnel and rinse out the beaker three times with small quantities of distilled water.
10. Add 5 ml dithizone solution from a burette, shake for 30 seconds, allow the layers to separate, and run the solvent layer into another clean separatory funnel.
11. Repeat the extraction with 5-ml portions of dithizone until the dithizone remains green in color. This indicates that all the lead has been extracted.
12. Add 20 ml alkaline potassium cyanide solution to the combined extracts.
13. Shake for 30 seconds, allow the layers to separate, and draw off the carbon tetrachloride layer into a 25-ml volumetric flask.
14. Dilute this solution with pure solvent to the mark and shake well.

C. Measurement of Transmittancy

15. Filter the solution through a clean Whatman No. 40 filter paper. Catch the filtrate in a clean, dry erlenmeyer flask.
16. After the instrument has been adjusted with pure carbon tetrachloride as the reference liquid, transfer a portion of the filtrate to a matching test tube. Rotate the dial until the galvanometer needle returns to the zero position and record the scale reading. If the instrument has a wave-length scale, set it for 520 millimicrons.
17. Run a blank, going through the above procedure with the same number of dithizone extractions as were required to extract the lead. Record the scale reading of the blank.
18. Subtract the blank reading from the sample reading. Record this corrected scale reading, and from the calibration curve read the amount of lead in the sample taken for analysis.

Calculations

Suppose that the corrected scale reading of the unknown is 200. According to the calibration curve this corresponds to 32.5 micrograms of lead. As one ml of the bath was taken for analysis, then $32.5 \times 1000 = 32{,}500$ micrograms or 32.5 ppm of lead is present in the bath. This is equal to 0.0325 g/l.

If a solution is known to transmit light in accordance with Bouguer-Beer's Law and the instrument has a logarithmic scale, it is possible to eliminate the need for a calibration curve.

An example will make the method clear. Run an unknown and a standard sample, simultaneously treating each exactly the same. Get their scale readings and correct for blanks as described above. Since the readings for both the standard and unknown are directly proportional to the concentration if the Bouguer-Beer's Law holds, the concentration of the unknown is calculated by the use of the following formula:

$$\frac{\text{conc. of standard}}{\text{corrected reading of standard}} \times \text{reading of unknown} = \text{concentration of unknown}$$

Suppose the standard contains 20 gamma of lead and has a corrected reading of 125. The unknown—using 1 ml of plating bath—gives a corrected reading of 175. Substituting these numbers into the above formula, the amount of lead in 1 ml of the bath under test is $(20/137) \times 175 = 28.0$ micrograms. Hence, in 1 liter there is $28.0 \times 1000 = 28{,}000$ micrograms $= 28.0$ ppm or 0.028 g/l of lead.

Once the standard has been run, it is not necessary to run it with each unknown—although it would be desirable—since

$$\frac{\text{concentration of standard}}{\text{corrected reading of standard}}$$

is a constant. It would only be necessary to multiply the scale reading of an unknown by this constant factor to get the concentration of lead in the unknown.

"Stop and Go" Method

If the *p*H of the solution has been ad-

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justed correctly and the strength of the dithizone solution is constant, the number of extractions required to remove the lead can serve as a stop-and-go method.

Procedure

1. Follow the "Recommended Routine Procedure" up to and including step 9.
2. Add 5 ml of dithizone and shake for 30 seconds. Allow liquid layers to separate. If the bottom layer is green, there is less than 10 micrograms of lead present.
3. Run off the carbon tetrachloride layer. Add another 5-ml portion of dithizone and repeat step 2. If it remains green less than 30 micrograms of lead are present.
4. If the third 5-ml extraction is green, then less than 50 micrograms of lead are present.

By noting the various shades of purple of each extract, an operator will soon be able to estimate the lead content within 10 micrograms without much difficulty.

Discussion

There are several critical points in this procedure that must be carefully watched if good results are to be obtained.

1. One must not allow samples to fume for any appreciable length of time after the organic matter has been oxidized. Failure to watch this point will cause erratic results.

2. The *p*H must be carefully adjusted. If not, other ions will be extracted along with the lead. Tests showed that *p*H values in the range between 8.6 and 9.0 will give satisfactory results, but to be on the safe side, it is recommended that the *p*H be adjusted to around 8.8

3. The time of boiling the solution after the addition of the hydroxylamine hydrochloride must be controlled with some care. A minute or so longer than 10 minutes causes no trouble, but if time is allowed to go to 15 minutes or more the results tend to become erratic. At times, the solutions become cloudy at this point, but this turbidity clears up later in the procedure.

4. As mentioned in the section on developmental work, do not let the solutions stand around for any length of time after the addition of the potassium cyanide. If the analysis must be stopped and not resumed for a few hours or overnight, it is best to stop after the addition of the sodium tartrate solution.

For the amount of copper plus impurities present in the bath used for this investigation, 8 ml of the 5 per cent potassium cyanide will be sufficient to complex all the metallic ions. If much more copper is present, the volume of the cyanide will have to be increased by an amount that should be determined experimentally. Use the purest grade of potassium cyanide available. Small traces of sulfide will precipitate the lead and some bottles of so-called pure reagent have been found to contain appreciable quantities of metallic material.

It cannot be emphasized too strongly that all reagents used should be as lead free as possible including all the water used in the analysis and for cleaning the glassware. Water and sodium tartrate can be shaken with a few millimeters of dithizone solution to remove traces of lead.

When the solutions are made ammoniacal, the deep blue color of the ammoniacal copper complex will fade at an appreciable rate. The addition of more ammonium hydroxide will not change this color.

After the addition of the potassium cyanide, the color will change to a yellowish shade and then to green. All samples should have this color at this point in the procedure. At the same time, a white solid will separate out—ammonium perchlorate. It causes no difficulty in the procedure as it remains at the interface between the aqueous and carbon tetrachloride layers when the lead is extracted and practically all of the solvent layer can be run off without allowing much of the salt to come through. If there is no organic matter in the copper bath, the treatment with perchloric acid may be omitted. Then, after a sample of the bath has been pipetted into a 50-ml beaker, sodium tartrate can be added and the recommended routine procedure followed from this point.

Applicability of the Method

This method has been developed to be applicable to all types of plating baths including cyanide copper baths. Treatment with perchloric acid should leave any type of bath comparable in composition to a simple acid copper bath. If the perchloric acid oxidation is carried out as described, there is little danger from explosions unless the bath contains a large quantity of organic matter. In this case, it might be safer to add about 2–3 ml of nitric acid, take the sample down to fumes of this acid, and cool before adding the perchloric acid.

Summary

A method for the determination of lead in copper plating baths is described. After the organic material is oxidized with phosphoric acid, the lead is separated from interfering ions by extracting with a CCl_4 solution of dithizone in the presence of KCN. After removal of the excess dithizone with alkaline KCN, the transmittance of the solution is measured and the quantity of lead determined from a calibration curve.

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Electrocoloring

(*Continued from page 160*)

tions are imposed on its use by virtue of the extreme thinness of the colored oxide film. Articles colored by the process cannot be used under anything more than moderate abrasive conditions. Moreover, some of the colors, particularly those produced by the immersion method, cannot be handled without leaving fingerprints. The black and blue colors offer the best resistance to handling; in fact, both show excellent properties in all respects.

Some examples of the decorative coloring of stainless steels include stainless-steel trays, watch bands, hardware fittings, panelling, serviette rings, cutlery, etc.

SUMMARY

Various reported methods for coloring stainless steels in modified sulfuric acid solutions have been tried, the best conditions being found by experiment where details were not available in the literature. One of these methods, the electrolytic method, was found to be superior from the standpoint of production control. This method has been described in detail.

In the experiments with the galvanic method, the conditions under which colored films could be formed did not correspond with those described by Batcheller; no explanation can be given at present for what appears to be an anomalous effect, and it is hoped that other investigators will publish any results which may afford a complete or even partial understanding of the phenomenon observed.

The colors produced on stainless steel were of the interference type; opaque colors described by Batcheller were not produced. Details for the method of producing this opaque type of color have not been described in the literature.

In conclusion, it is hoped that this brief treatment will be of some interest to those engaged in the fabrication of stainless steels. The process, although limited in its applications, is undoubtedly a useful one and should find wider use in the future.

ACKNOWLEDGMENT

The author desires to thank Messrs. J. J. Dale and R. W. Gibbons of the Defence Research Laboratories for advice and encouragement in carrying out the work described in this paper.

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Nickel Plating

(*Continued from page 146*)

ties up to 100 asf (10.8 amp/dm²) are high, not very different from those in the Watts bath.

4. The fluoborate bath is a high-conductivity bath, comparable to the all-chloride electrolyte in this respect.

5. Good adhesion of nickel to steel and copper surfaces is readily obtained in this bath.

6. The tendency to form trees on heavy deposits is less than with a Watts bath but greater than in the chloride bath.

7. The residual contractile stress in fluoborate deposits is only about two-thirds of that in nickel from the Watts bath plated under comparable conditions.

8. The tolerance for impurities seems to be about the same as for the Watts and chloride baths. Iron causes an increase in contractile stress in all three baths.

9. Although no corrosion tests were made during this work it should be noted that the producers of nickel fluoborate do not recommend the use of lead or high-silicon cast iron in contact with the fluoborate bath. This is a disadvantage, but rubber, pyrex glass, carbon, and certain corrosion-resistant steels are said to be satisfactory.

10. In spite of a high cost of the principal ingredient, the fluoborate bath should be considered whenever an easily controlled process is desired for making moderately stressed, ductile nickel deposits at a rapid rate.

ACKNOWLEDGMENT

The nickel fluoborate solution from which the baths used in this work were prepared was donated by the General Chemical Company which also provided instructions for analysis of such solutions. The advice and cooperation of Messrs. A. E. Carlson and C. Struyk of the Technical Service Department of that company are gratefully acknowledged.

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QUESTION BOX

readers' questions of general interest

Q. 73. What method can be used to remove copper from a chromium plating solution? I am under the impression that it can be done by adding some chemical.

A. I have asked several people, and putting all answers together I conclude that it is apparently possible to remove copper from a normal chromium plating solution by plating upon a copper cathode with a porous diaphragm, or porous cells, between anode and cathode. This method was used during the war to regenerate chromic acid strips containing relatively high concentrations of copper. It is not known how complete the removal can be, i. e., if it will remove copper in concentrations of 1-2 oz/gal. The concensus is that unless the volume of solution is large, it is cheaper to discard than treat it.—B. C. Case.

Q. 74. What is a good method for stripping rhodium from brass?

A. Rhodium being a noble metal, it is not attacked even by aqua regia except when finely divided, but since electroplated rhodium coatings are extremely thin, less than 0.000005 inch (0.125 μ) they are quite porous. For this reason it is possible to remove the rhodium by dissolving the underlying nickel coating, all basis metals except gold and platinum being preferably plated with nickel before they are immersed in the strongly acid rhodium solution.

The usual procedure is therefore to treat anodically in a strong sulfuric acid solution of 55–65° Bé (sp. gr. 1.61–1.81) at room temperature with 6 volts or higher across the tank terminals. Stripping is faster the more dilute the solution or the higher its temperature, but the etching of the brass is also increased. Proprietary inhibitors are available for the process. Care should be taken to maintain positive contacts during the stripping.

The use of polythene cubes, tubes or rods on top of the stripping solution decreases the amount of acid carried out by the gas evolution and reduces absorption of water by the strong sulfuric acid during idle periods.

This method is not recommended for use with sterling-silver basis metal. Immersion in hot concentrated hydrochloric acid or anodic treatment in hydrochloric acid has been used with that basis metal.—Edward A. Parker.

A. The only acid which will slowly attack and dissolve rhodium is fuming sulfuric acid at elevated temperature.

Since in most cases rhodium, in thicknesses of from a few to ten millionth of an inch, is plated over nickel it can be removed in flake form in the common reversed-current sulfuric acid nickel strip.

Very often it is possible to salvage a piece by plating nickel, copper, or silver over the defective rhodium plate. Stripping for recovery of rhodium does not pay. —K. Schumpelt.

Q. 75. Can you outline means of heating an iron bath containing 50 as/gal each of ferrous chloride and calcium chloride operated at pH 0.5–1.0 and 195° F? We would like to use steam coils.

A. Duriron gives very satisfactory service and is available in various forms such as jets, heat exchangers, etc., from the Duriron Company, Dayton, Ohio. Karbate equipment, made by National Carbon Company, should also be all right.—T. F. Slattery.

A. A Karbate immersion heater should be most suitable for your requirements. They are available in several different designs, and we suggest that you write to Heil Process Equipment Corporation, Cleveland, Ohio.—Charles L. Faust.

Q. 76. Can you give me a formula which is suitable for obtaining a black or deep-blue finish on cast-iron stove parts? I have tried several formulations, but they do not seem satisfactory.

A. It is inferred that the parts will be subjected to elevated temperatures, and, if so, many of the blue or black finishes produced by chemical methods will not hold the original color. Oxide finished are relatively stable with heat and would seem to be the best choice. However, it is difficult to produce a black color on cast iron by treatment in the usual alkaline oxidizing solutions. The color obtained on cast iron ranges from the purplish-brown to a red rust.

Upon numerous occasions we have produced a deep black finish on cast-iron parts in the alkaline oxidizing bath by first applying between 0.0001 and 0.0002 inch by electrolytic iron from one of the baths described in "Modern Electroplating". The usual cleaning and pickling procedures employed for cast iron suffice to make the surface receptive to the electrolytic iron deposit.—Myron B. Diggin.

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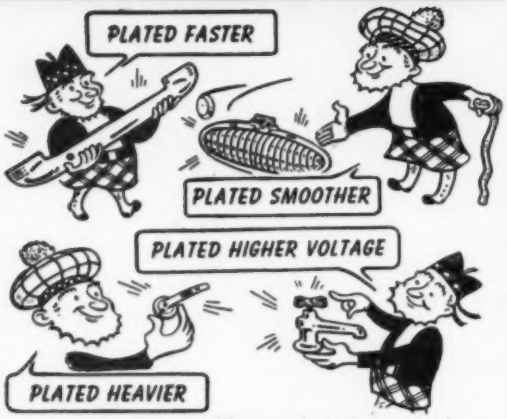

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Book Review

DR. HAROLD J READ

Associate Professor of Metallurgy, Pennsylvania State College

BORON TRIFLUORIDE AND ITS DERIVATIVES by Harold Simmons Booth and Donald Ray Martin, 1949, ix + 315 pages. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $5.00.

The present commercial use of several metallic fluoborate compounds as the primary constituents of plating solutions makes the subject of boron trifluoride and its derivatives a matter of interest to metal finishers. Most inorganic reference texts deal only superficially with these compounds, both because they are relatively new as commercially available chemicals and because their applications have been quite limited in the past. The monograph under review is an integrated presentation of modern knowledge of the preparation, properties, reactions and uses of these materials.

The first part of the book treats of the history, preparation, chemical properties and physical properties of boron trifluoride. Although this part of the text is well and clearly written (as is the entire volume), one wishes that it were somewhat more critical. It is found, for example, in many cases where some physical property is discussed that several values will be given with little or no indication as to which is likely to be the most correct. There are numerous tables and graphs which present much information in concise form.

A chapter on the coordinating power of boron trifluoride is well organized and deals in a very lucid manner with a difficult subject.

A large portion of the book is devoted to fluoboric acids and their salts and to the use of boron trifluoride and its derivatives as catalysts. The references to electroplating are brief and would be of no direct use to practical platers. The detailed presentation of the chemistry of the compounds which are or might be employed in plating is, however, of great potential value to electrochemists in the field of metal finishing.

The last two chapters cover the analysis and handling of the materials discussed in the book. This information is extremely useful and is likely to save investigators much tedious searching of the literature.

The book is extensively documented with 973 references to the journal and patent literature. In addition to adequate author and subject indexes, there is a formula index which should save time in locating references to compounds which may be ambiguously named.

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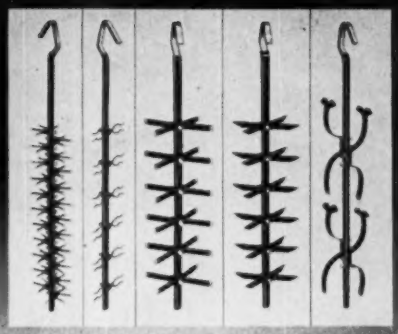

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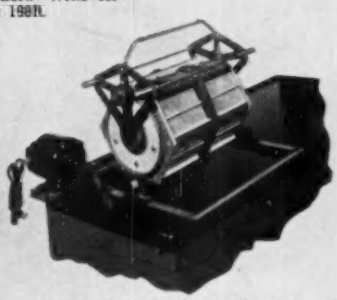

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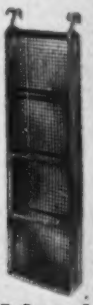

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Describes new process for depositing zinc, cadmium or tin by chemical displacement upon aluminum. Immersion solutions contain the metal sulfate and either hydrofluoric acid or the fluoride anion. The deposited metals have good appearance, sound structure, and excellent adhesion. The zinc-aluminum bond is the best and is higher than the cohesive strength of the base metal. 58 ref.

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Reports results of experimental studies on the effect of inhibitors and accelerators in the pickling of steel. Terms are defined and explained; tables and graphs summarize the experimental results.

Metal Coatings Improve Solder Flow on Steel and Brass. David Wallace. Materials & Methods **29**, 60–63 (May, 1949).
Experience and tests with a number of hot-dipped and electroplated coatings show that plated lead-tin alloy provides best solderability with rosin flux. Solder spread on various coated brass surfaces is illustrated, showing results after 6 and 9 months' aging, as well as immediately after plating.

Significant Strength of Steels in the Design of Machine. II. Charles Lipson, G. C. Noll, and L. S. Clock. Product Eng. **20**, 124–128 (May, 1949).
Describes effects of cold working, surface hardening, and plating on the strength of materials used for machine parts. Relationship between fatigue strength and life expectancy in service is correlated, and a practical method of constructing diagrams is described for obtaining allowable stress values for any finite life.

The System Metal-Solution as a Simple Electrode. I. Number and Type of Ion Transfers in the Metal-Solution System (Metal Electrode). K. Nagel. Arch. Metallkunde **3**, 33–38 (January, 1949). A theoretical discussion of the kinetics of ion transfer, especially with simple electrodes (electrochemical polarization). Includes explanatory diagrams. 10 ref.

Chromizing Process as Developed and Used by Diffusion Alloys Limited of London. C. A. Naugle. Cado Tech. Data Digest **14**, 13–19 (November 1, 1949). The chromizing process recently developed by Diffusion Alloys Limited is essentially the same as the German process, employing the principle of an atom exchange between iron and chromium at high temperature. However, the method is different in that articles to be chromized are packed in carburizing pots; the use of retorts and hydrogen chloride jets is eliminated by a ferrochrome kaolin powder to which a halide is added to form chromous iodide, which in turn allows diffusion of chromium to occur at relatively low temperatures (1850°–2150° F). The chromium-alloyed surface is approximately 40 per cent in chromium and is heat, erosion, and corrosion resistant, as well as resistant to nitric acid. The process appears commercially feasible and adaptable for use in both small and large shops.

Aluminum—Its Surface Preparation and Finishing. I. E. R. Yarham. Prod. Fin. 38–52 (September, 1949).
Described in this article are methods of cleaning and degreasing and also the first two of the various finishing processes which are divided into four main sections—mechanical, chemical, electroplating, and paint finishes. Organic solvents, alkali solutions, or combinations thereof are used for cleaning and degreasing; application of the liquids is by hand swabbing, immersion dipping, or vapor spraying. Mechanical finishing processes, including grinding, sandblasting, shot blasting, scratch brushing, and barrel polishing, are discussed. Chemical surface treatment is covered in a discussion of the "normal process". The method of finishing to be applied depends upon (1) the nature of the materials used and the treatment they have received previously, and (2) the purpose, appearance, and service conditions of the completed article.

Fatigue Limit of Chromium Plated Steels for Aircraft. Nat'l Bur. Stds. Tech. News Bull. **33**, 113–115 (October, 1949).
A study has been made of the effect of chromium plating on the fatigue limit of steels used in aircraft. From the results it was concluded that the decreased fatigue limit accompanying heating to 392° F (200° C) of the fatigue-test specimens was due to increased tensile stresses induced in the chromium plate. If the chromium plated steel is heated to a sufficiently high temperature (above 752° F; 400° C), the contractive forces in the chromium produce sufficient tensile

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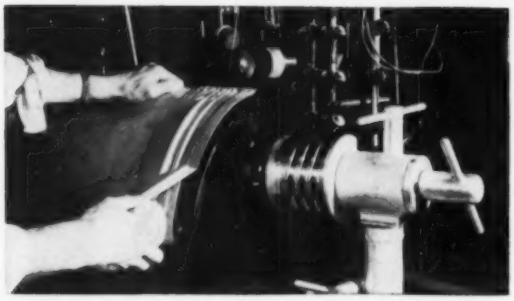

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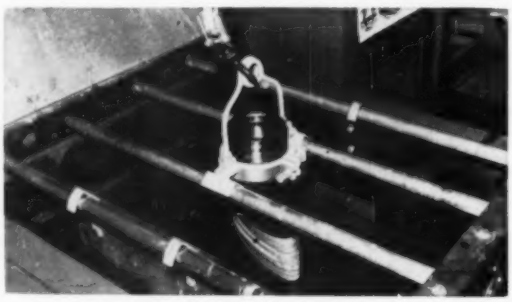

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stresses to cause plastic flow or rupture of the chromium plate, thus relieving the residual tensile stresses in it. Thus, when "tongued" tubes were heated above 400° C, the free ends of the tongues were depressed below the surfaces of the tubes, indicating a release of the restraint in the steel initially caused by residual tensile stresses in the chromium.

Causes of Blistering of Electrodeposits on Zinc Alloy Die Castings. S. Wernick, H. H. Symonds, and H. C. Castell. J. Electrodepos. Tech. Soc. **24**, 195–210 (1949).

The authors divide blisters on plated zinc-base die-castings into two groups, viz., "service" blisters and "process" blisters, the former being those appearing during service and the latter those encountered immediately upon completion of the plating cycle. The literature is reviewed, and the bibliography is good. Some 32 photomicrographs of cross-sections of blisters and of intergranular corrosion are presented. The most important conclusions are: "The main causes of 'process' blisters are related to the production of locally corroded sites or areas on the casting surface which adversely affects the deposition of sound plating. The surface corrosion of the casting is intergranular in character, providing conditions which can result in the trapping of chemical solutions, electrolyte, etc. It seems probable that interaction between the latter and the zinc, or between entrapped solutions, gives rise to gaseous products resulting in local pressure with the formation of blisters", and "The most effective means of countering the formation of 'process' blisters is to prevent the corrosion of the casting surface by (a) avoiding storage under corroding conditions; (b) protecting the casting during the period it is left in the as-cast or polished condition prior to plating". In this paper there is, unfortunately, no mention whatsoever of the cleaning cycle prior to plating. It seems obvious to this abstractor that the sequence of preparatory operations and the materials and conditions used are of prime and absolute importance, and that any work on blistering loses much or all of its value if this information is not given.—LYMAN B. SPERRY.

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Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,487,399, November 8, 1949—Electroplating Apparatus—A. E. Thurber, assignor to Oneida, Ltd.

CLAIM 1. Electroplating apparatus comprising a cathodic cell, an anodic cell, a porous membrane separating said cells, means for circulating electrolyte to and from said anodic cell and purifying the same during such circulation, comprising an outlet connection from the bottom of the anodic cell and a first tank for receiving electrolyte from said anodic cell and having an overflow to maintain the level of said tank and said anodic cell below the top of said membrane, a second tank for discharging electrolyte into said cathodic cell and having an overflow to maintain the level in said second tank and cathodic cell above the top of said membrane for causing overflow from said cathodic cell to said anodic cell, and means for maintaining a flow of electrolyte from said first tank to said second tank.

2 claims, 1 figure.

References cited: U. S. Patents 512,266; 686,395; 814,864; 871,161; 874,064; 961,945; 1,371,699; 1,395,827; 1,587,438; 1,945,107; 1,980,381; 2,014,148; 2,288,503. Australian Patent 18,390/29.

No. 2,485,182, October 18, 1949—Aluminum Plating Process—Arthur Arent, assignor to Arthur Arent Laboratories, Des Moines, Iowa.

This invention relates to the art of applying protective coatings or plates to aluminum-containing objects and more particularly to the art of producing corrosion-resistant antimony surfaces in commingled union with aluminum-containing metal. Heretofore when it

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has been necessary to provide corrosion resistant coatings for aluminum, it has been necessary to employ "anodizing" processes in order to obtain a bond between the coating material and the aluminum. Such processes are relatively slow and quite expensive as well as being uncertain in result, and for these reasons the "anodizing" treatment has only been resorted to where the cost factor is not important.

CLAIM 1. The method of cold plating aluminum-containing metals which comprises wetting the surface of such a metal with the solution reaction product of the intermixture of anhydrous antimony trichloride with a brine selected from a group consisting of sodium chloride, potassium chloride, and calcium chloride brines for an interval sufficient to induce a surface reaction in which metallic antimony forms on the aluminum surface in commingling union therewith.

9 claims.

References cited: U. S. Patents 1,186,217; 1,207,218; 1,211,564; 1,436,729; 1,607,676; 1,770,828. Mellor, "Comprehensive Treatise on Inorganic and Theoretical Chemistry", vol. 9 (1929), p. 474.

No. 2,488,246, November 15, 1949—Process of Electroplating Zinc and Baths and Compositions for Use Therein—J. E. Stareck and F. Passalacqua, assignors to United Chromium, Inc.

It is desirable and advantageous (1) to electroplate smooth zinc deposits, (2) to electroplate bright deposits of zinc, (3) to electroplate such deposits with high current efficiency, (4) to make use of noncyanide alkaline baths which are free from cyanide fumes, (5) to make use of baths less alkaline than cyanide-zinc baths, yet of such alkalinity that iron is not soluble in the bath, (6) to have baths in which the *p*H remains fairly stable, (7) to have an alkaline bath with which air or mechanical agitation can be used without building up carbonates or other objectionable reaction products therein, (8) to electrodeposit zinc at greater speed than by other processes making use of alkaline baths, (9) to avoid as much as possible hydrogen embrittlement of the base metal in the process of electrodepositing the zinc, (10) to obtain brighter deposits than are obtained by processes heretofore used, (11) to electrodeposit zinc on cast iron without special preliminary steps, (12) to have a process of electrodepositing zinc which works well in barrel plating, (13) to make use of baths which are not corrosive to equipment and which do not give off poisonous fumes; the foregoing advantages are obtained by the use of the process and baths of the present invention.

. . . . . a bath is used which contains the complex compound potassium zinc pyrophosphate $K_6Zn(P_2O_7)_2$, has a controlled *p*H, and contains a substance which acts as a brightener and a throwing-power promotor.

EXAMPLES OF BATHS

	g/l
I. $Zn_2P_2O_7.3H_2O$	68
$K_4P_2O_7$	360

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corresponding to	
Zn	25
P_2O_7	225
II. $ZnSO_4 \cdot 7H_2O$	110
$K_4P_2O_7$	375
corresponding to	
Zn	25
P_2O_7	225

A brightener is added to the bath and is a solution-soluble carbocyclic compound having hydroxy and methoxy groups ortho to one another, specific examples of which are curcumin, phenol sulphonate condensation products of vanillin, and ortho-hydroxy meta-methoxy benzaldehyde, the last of which we have found to be the most satisfactory to use.

.... for reasonable speed of deposition and brightness of the zinc deposit temperatures from room temperature to 140° F may be used.

..... with aforesaid baths, current densities of from 20 to 70 amperes per square foot are optimum.

For anodes, electrolytic zinc or cast zinc of high purity is recommended. Citrate radical in the bath, in quantity of about 15 g/l, may be used as a depolarizer.

A mode of procedure followed in plating steel cartridge cases is as follows:

Bath Composition	
Zn, g/l	23
P_2O_7, g/l	210
Citrate, g/l	15
Brightener, ortho-hydroxy meta-methoxy benzaldehyde), g/l	1
Wetting agent (pentaoctyl sodium tripolyphosphate, g/l	½
Antifoamant (trioctyl phosphate), g/l	0.01
*p*H	11.5

Claim 3. A process of electrodepositing smooth zinc plate, which comprises passing an electric current from an outside source from an anode to a cathode article immersed in an aqueous bath solution at from room temperature to 140° F and at from 1 to 80 amperes per square foot consisting essentially of pyrophosphate radicals and zinc in the molecular ratio of approximately from 2.3 to 1 to 4.6 to 1, and optimum amounts of approximately from ½ to 3 grams per liter of ortho-hydroxy meta-methoxy benzaldehyde, acting as a brightener, and having a *p*H between 9.5 and 12.5.

4 claims.

References cited: U. S. Patents 744,170; 809,492; 1,681,509; 1,791,082; 2,080,479; 2,250,556; 2,315,607; 2,318,592; 2,360,135; 2,393,517; 2,447,297. Appl. Ser. No. 255,552 by Howaldt *et al.* (A. P. C.), pub. May 18, 1943. J. Am. Chem. Soc. **18**, 654. "Electrodeposition of Metals" by Langbein and Brannt, 9th ed. (1924), p. 567. "Wood Chemistry" by Wise (1944), pp. 272–360. Trans. Electrochem. Soc. **88**, 272 (1945).

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No. 2,488,856, November 22, 1949—Automatic Regulation of Electroplating Apparatus—W. Fero, assignor to Clark Controller Company, Cleveland, Ohio.

CLAIM 2. In a continuous strip plating system, an electroplating apparatus: feeding means continuously feeding a strip of metal to be plated through the plating apparatus; plating-current supply means supplying electric current to the plating apparatus, the current amperage and strip speed being adjustable relatively to have a predetermined quantitative ratio value at which a desired plating operation is performed on the strip; an automatic regulating means comprising an actuating circuit and means subjecting the circuit to two opposing potentials, one proportional to the amperage and the other proportional to the strip speed, and comprising an actuated movable element movable in one direction or the other respectively by current in the actuating circuit, responsive to the imbalance of said potentials effected by the preponderance of one potential over the other occurring upon a change of said ratio value and movable at a rate commensurable with the amount of preponderance; the plating-current supply means comprising an electric generator and a generator control to vary its current output; the generator comprising means responsive to variations of main current through an electronic control tube having a control grid; a network energized by current-supplying means and supplying main current through the tube; the network comprising photo-tube means, and energizing the control grid variably to vary the current through the control tube responsive to variations of illumination of the photo-tube means; light-producing means and means coacting with the movable element to vary the illumination of the photo-tube means by light from the light-producing means in correspondence with different positions of the movable element, whereby the illumination is varied more rapidly by more rapid movement of the movable element effected by a greater preponderance of one said potential over the other in the actuating circuit; and means responsive to the occurrence of preponderance of that potential which is proportional to strip speed to augment temporarily the resultant current in the actuating circuit, comprising a resistor in the actuating circuit and a normally charged condensor bridging the resistor.

2 claims, 1 figure.

References cited: U. S. Patents 1,820,786; 1,965,399; 2,066,934; 2,136,682; 2,147,422; 2,251,277; 2,325,401; 2,427,661.

No. 2,491,126, December 13, 1949—Method of Electroplating on Chromium or Chromium-Iron Alloys—E.

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CLAIM 1. A method of electroplating on a basis metal consisting essentially of chromium and iron, said method comprising cleaning and then drying said basis metal, dipping said basis metal in a bath of a fused salt from the class consisting of sodium bisulfate and potassium bisulfate, whereby said basis metal is provided with a thin film of said salt to protect the basis metal from oxidation, withdrawing the filmed metal from said bath, allowing the filmed metal to cool, and then electroplating upon said basis metal in a bath of a metal from the class consisting of nickel and copper, whereby the bisulfate is dissolved and is replaced by a coating of said last mentioned metal.

CLAIM 2. A method according to Claim 1 in which said basis metal consists of chromium.

2 claims.

References cited: U. S. Patents 20,306; 1,665,638; 1,726,623; 1,795,512; 1,950,689; 2,285,548; 2,293,810; 2,353,026; 2,419,190; 2,441,776. British Patent 527,754. Swedish Patent 133,813. Iron and Steel, 501 (June, 1944).

No. 2,489,523, November 29, 1949—Electrodeposition of Tin or Lead-Tin Alloys—F. L. Clifton, assignor to General Motors Corporation.

CLAIM 2. The process of preparing an electrolytic bath for simultaneous deposition of tin and lead consisting essentially in providing an aqueous solution of sulfamic acid, placing in said solution an anode of tin, electrolyzing said solution, thereby forming therein a compound of tin with sulfamic acid soluble in said solution, adding to the solution lead sulfamate, and adjusting the sulfamic acid content to result in a *p*H of approximately 1.4 to 2.4.

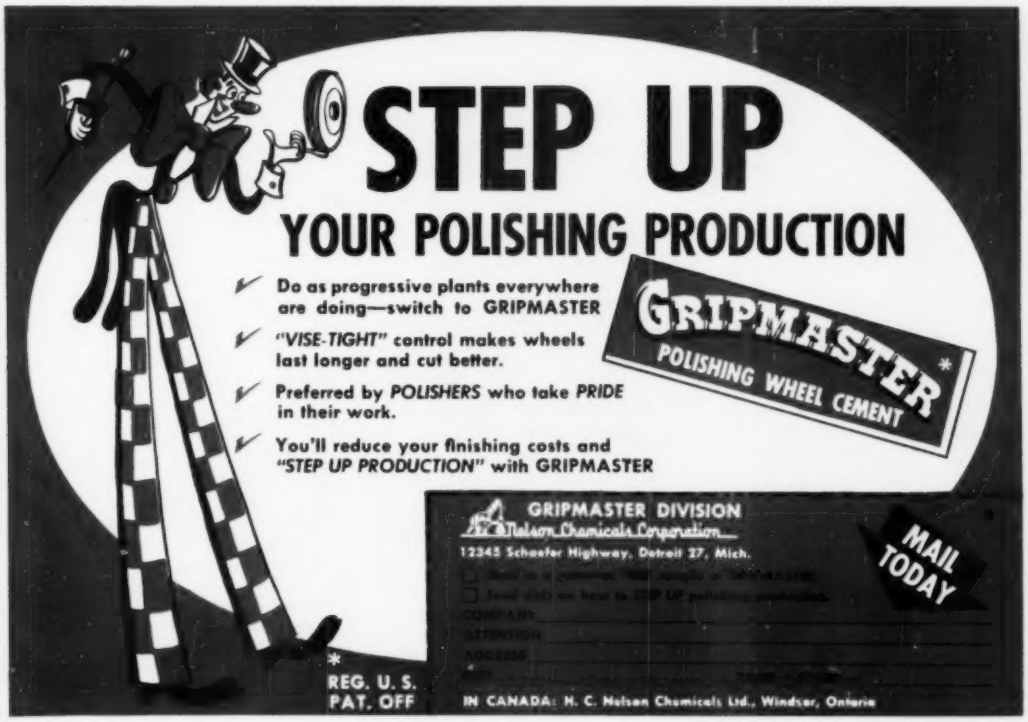
CLAIM 7. The process of electrodepositing an alloy of lead and tin by electrolyzing an aqueous solution having as its essential ingredients water, sulfamic acid, lead sulfamate and a compound of tin and sulfamic acid, the lead and tin salts being present in proportions to yield a deposit having a tin content of 1–30 per cent.

CLAIM 8. The process as set forth in claim 7 including maintaining the content of tin and lead in the solution by use of anodes having approximately the content of the alloy to be deposited.

CLAIM 9. . . . maintaining the solution at a *p*H of approximately 1.4 to 2.4 by adjustment of the sulfamic acid content.

9 claims.

References cited: Chem. Abst. **34**, 677, 678 (1940). Trans. Electrochem. Soc. **40**, 291 (1921). Chemica e industria (Italy) **21**, 478–491 (1939).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Equipment and Supplies

E—409. Chemical Feeder—A compact, self-contained chemical feeder, the Feed-Rator is now available from the Fischer & Porter Company, Hatboro, Pa. Of transparent acrylic plastic and measuring about 10 × 5 × 2 inches overall, this unit simultaneously controls, meters and dispenses relatively small amounts of in-

hibitors, reagents or other chemicals into a larger stream. The built-in eductor takes the place of a pump, and many highly corrosive chemicals can therefore be fed directly from a container

The unit will treat up to 7,000 gallons per day of water directly. In a bypass arrangement, using a solution containing 5 per cent active reagent by weight, 5 parts per million of the reagent can be delivered to over 14,000,000 gallons of water per day. For further information, use Reader Service Card.

E—410. Corrosion Resistant Cement—The Electro Chemical Supply & Engineering Company, 750 Broad Street, Emmaus, Pa., announces a new thermo-setting synthetic-resin cement, Lecite. It is said to be inert to solvents, fats, oils, greases, alkalis and acids, except strong chromic, nitric, and sulfuric over 60° Bé at temperatures to 375° F, and to be particularly useful for jointing acid-proof brick and pipe. Lecite may be stored indefinitely at atmospheric temperatures, is nontoxic, will not foam to form a porous mortar or give off toxic fumes, sets quickly to form a dense, shiny, shock-resistant joint, is nonflammable, and has a compression strength in excess of 10,000 psi. For further information, use Reader Service Card.

E—411. Filterless Dust Collector—Model 30N50 Dustkop develops 3630 cfm (velocity 10,400 feet per minute) yet measures only 28 x 49 inches in floor space x 82 inches in overall height. This combination of large volume with minimum space requirements usually permits the installation of standard-stock dust-control equipment immediately adjacent to any new source of the dust, according to Aget-Detroit Company, Ann Arbor, Mich. Portability, in case of changes in production lay-out, is also a feature claimed for the unit.

Typical dust sources that are handled include four grinding, buffing, or polishing wheels of 19–24 inch diameter; multiple abrasive or sanding belts; dust from chemicals, etc. For further information, use Reader Service Card.

E—412. Spectrographic Equipment—Perkin-Elmer Corporation, Glenbrook, Conn., now offers the Model 83 Monochromator, said to be the first universal monochromator covering the ultraviolet, visible, and infrared regions of the spectrum (0.18–40 microns) when suitable prisms or gratings are used.

Metal industries make wide use of standard visible and ultraviolet spectrophotometers for extremely rapid chemical analyses, but frequently problems arise requiring a higher degree of spectral quality than possessed by standard equipment. With the Perkin-Elmer Universal Monochromator as the basic component, instruments can be constructed to meet new situations as they develop. For further information, use Reader Service Card.

E—413. Miniature Pump—A low-cost miniature electric centrifugal immersion pump, developed and sold by Samuel S. Gelber Company, 162 N. Clinton Street, Chicago 6, Ill., including motor has an overall height of less than 3 inches and weighs only 16 ounces. The fleapower motor is specially treated to withstand moisture.

The pump, which is said to have only one moving assembly, no metal to metal,

no bearings to wear, no packing to leak, gives 44 gph at free discharge, 30 gph at 12 inches, shuts off at 20 inches. It is available in 110 volts, 60 cycles, single phase only. For complete details, use Reader Service Card.

E—414. Magnifier—To speed up inspection and assembly of small parts, a new visual aid, the Desk Magnalite, is being marketed by the Haas Corporation, Mendon, Mich.

The tool consists of a large 5-inch lens set in a plastic head with two fluorescent lights built in on the underside. Flexible-arm mountings permit instant adjustment and leave both hands free.

Magnalite is manufactured in three styles of mountings, the new H-25 Desk Model, the H-50 Universal Clamp Model, and the H-100 Pedestal Model. In addition, special mounts can be made to specifications. For further information, use Reader Service Card.

E—415. Molded Pail for Corrosives—A new molded 3-gal pail, utilizing a virgin-rubber-base compound and other original features for greater safety and serviceability in the handling of acid and alkaline chemicals, has been developed by Stokes Molded Products, Inc., Trenton 4, N. J.

Described as light, shock resistant, rigid, and almost chemically inert, the new pail is equipped with a bail-type handle of lead-plated stainless steel with a hard rubber grip. Other safety features are the pouring lip which reduces drip and the molded tipper on the bottom of the pail which provides a firm hold for accurate control in pouring hazardous contents.

The pail is supplied with graduated markings for measuring one to twelve quarts or one to three gallons. For further information, use Reader Service Card.

E—416. Workable "Teflon" Tetrafluoroethylene Resin—Widespread use of "Teflon" tetrafluoroethylene resin has been held up by difficulties encountered in fabricating it. The very properties that endowed it with great potential industrial value—outstanding heat and chemical resistance—made it difficult to work into readily usable forms.

It has now been discovered that the material could be made as a suspensoid containing up to 65 per cent of solids. In this form the particles are so fine that they remain suspended in the carrying liquid for considerable periods of time with little or no settling.

There are three types of "Teflon" spray coatings—primer, intermediate, and finish. The process for applying each is similar. Before spraying the primer, it is necessary to clean the metal surface, washing off grease with a solvent, and, preferably, sand blasting to assure the best possible adhesion. After spraying, the coating is air- or force-dried at temperatures below 200° F. The metal is then heated, either by baking in an oven or by spot-heating, until the temperature is brought to around 750° F. At this point the tiny particles of solid "Teflon" turn to jelly and fuse together, giving a continuous film. As the metal cools, the film becomes solid. If thin spots are found, or damage occurs after use, the finish can be patched by cleaning down to the metal, applying more spray finish, and fusing with blow torch or gas flame. Repairs can be made in 15 to 20 minutes.

"Teflon" tetrafluoroethylene resin fin-

ishes will adhere to many metals, such as steel, stainless steel, aluminum, brass, copper, and to glass (after sand-blasting), porcelain, and brick. In general, four to six coats will suffice for corrosion protection, a primer about three-tenths of a mil thick and intermediate and finish coats of a mil each. Against the more corrosive chemicals, a greater margin of safety can be obtained by building up a heavier film.

Field tests are being made of the material in electroplating tanks and on racks.

The new forms of "Teflon" tetrafluoroethylene resin are available in experimental quantities at development prices from Polychemicals Department, E. I. du Pont de Nemours & Company, Wilmington, Del.

E—417. Forged Copper Ball Anodes—A new forged copper-ball anode to replace the cast copper-ball anode is announced by The Udylite Corporation, Detroit 11, Mich. It is claimed to have a finer and more even grain, to be purer and much cleaner in the plating bath. All anodes are of uniform shape and weight. For further information, use Reader Service Card.

E—418. Portable Small-Lot Plating Barrel—New ease, speed and convenience in plating small odd lots are claimed for the small portable plating barrels for use in still plating tanks or special tanks announced by the Belke Manufacturing Company, 941-955 N. Cicero Avenue, Chicago 51, Ill.

Called Porto-Platers, the units are suitable for jewelry, odd-lot production, laboratory work, test runs, and similar work. They are available in three sizes with capacities of ¼, ½ or ¾ peck. Made of high temperature Lucite, they withstand all cleaning cycles and gold, silver, rhodium, cadmium, copper, nickel, zinc, tin and brass plating cycles at temperatures up to 185° F. A self-contained motor drive with plug connection makes the unit easy to transfer. For further information, use Reader Service Card.

E—419. Acid-Type Cleaner—Oakite Products, Inc., has announced a new, acid-type cleaning and surface-conditioning material, Oakite Compound No. 33, designed to remove rust, oxides, grease, oils and shop soils from metal surfaces and to prepare ferrous metals and aluminum for adhesion of paint, lacquer, or enamel finishes.

Dilute solutions are applied at room temperature by brush or cloth, allowed to soak on surfaces briefly, then removed by rinsing and hand-wiping to complete the operation. For washing medium-size or small parts, solutions may be employed in tanks or in acid-resistant washing machines at working temperatures of approximately 140° F. Water rinsing and quick drying complete the cycle. Where light rust is the principal soil on steel

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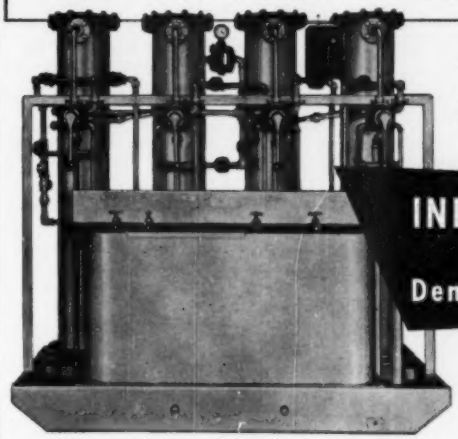

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besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

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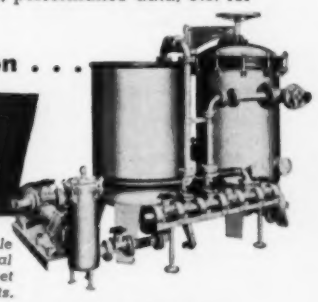

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1—15,000/7500 AMPERE, 6/12 VOLT **COLUMBIA ELECTRIC CO.** with Separate M. G. Exciter.

1—10,000/5000 AMPERE, 8/16 VOLT **ELECTRIC PRODUCTS CO.** Separately Excited, Synchronous Motor. Excellent Condition.

1—10,000/5000 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor. Excellent Condition.

2—7500/3750 AMPERE, 8/16 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor.

1—6000/3000 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor.

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1—2000/1000 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING.** Separately Excited.

1—1500/750 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING.** Shunt Wound. Separately Excited.

2—1000/500 AMPERE, 6/12 VOLT **CHARLES J. BOGUE ELECTRIC CO.** Separately Excited. Interpole Design. Exciter-in-Head.

1—1500 AMPERE, 40 VOLT **HANSON-VAN WINKLE-MUNNING** Anodizing Synchronous MG Set. Automatic Controls. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Anodizing Synchronous M. G. Set. Exciter-in-Head.

1—1000 AMPERE, 25 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Anodizing Unit.

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4—**G. E.** COPPER OXIDE RECTIFIER, 500 AMPERES, 6 VOLTS, for operation on 220/3/60.

1—2000 AMPERE, 6 VOLT, **GENERAL ELECTRIC CO.** COPPER OXIDE RECTIFIER for 220 volt, 3 phase, 60 cycle input.

2—1440/720 AMPERE, 6/12 VOLT **UDYLITE-MALLORY** RECTIFIERS, for 220/440 volt, 3 phase, 60 cycle input.

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Equipment and Supplies

parts separate pickling and rinsing operations may be eliminated. For further information, use Reader Service Card.

E—420. Stop-Off Material—A removable protective vinyl-coating material designed to prevent corrosion, scratching, or abrasion of metals during production, assembly, shipping, or storage has been introduced by Specialty Coatings Laboratory, 1721 N. Water Street, Milwaukee 2, Wis.

The coating is custom formulated for specific end uses, such as masking or stop-off lacquers and protective films for polished metals. For the latter application a corrosion-inhibiting composition has been developed to retard underfilm corrosion.

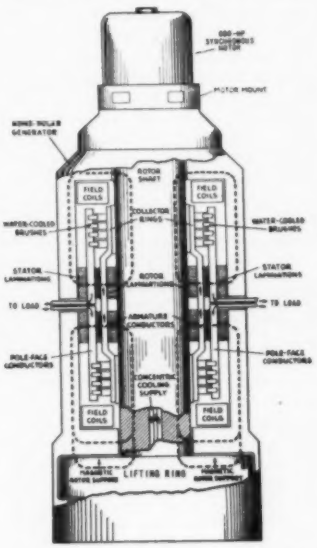
Applicable by spray, brush or dip methods, it is available in clear and a variety of colors, both translucent and opaque. A sprayed coating has a coverage of 250 to 300 sq.ft per gallon per mil thickness. It can be air dried or force dried. The coating can be peeled off or obtained in an adherent type for permanent protection. For further information, use Reader Service Card.

E—421. Capacitor Installation for Power Factor Improvement—According to the Apparatus News Bureau, General Electric Company, Schenectady 5, N. Y. The Empire Plow Company, Cleveland, Ohio, through a recent installation of four General Electric capacitors, effected an immediate increase in its power factor from about 61 per cent to an average of 97.3 per cent over a period of months. According to estimates, under the existing utility-rate structure, the installation will pay for itself in eight months. For further information, use Reader Service Card.

E—422. Sand Blast Helmet—A new light-weight helmet for protection against dust and abrasives in sand blasting operations has been developed by Willson Products, Inc., Reading, Pa. Besides for light weight (6 lb) the helmet has been designed for elimination of separate face mask, air being supplied through a perforated tube at the top of the helmet; with headgear-supporting hood containing a removable soft-felt skull cap, laced for adjustment to any head size; with flannel collar, zippered inside the hood and drawn together around the neck to make the hood dustproof; and with metal supports which keep the front of the helmet away from the face to allow the air stream to ventilate properly and insure non-fogging of the lens.

The equipment has the Bureau of Mines approval. The air supply to the equipment is accurately controlled by means of a breakvalve coupling, which automatically closes the compressed-air line when uncoupled. For further information, use Reader Service Card.

E—423. Homopolar Generator—The Electric Products Company, Cleveland 12, Ohio, has recently built a homopolar generator for use in nuclear-physics research by the Carnegie Institute of Technology. Rated 400 kw (21,000 amp at 18.7 volts) this d-c generator is noteworthy because of potential use in the plating industry, recent inquiries from the electrolytic industry having indicated the need for equipment capable of supplying low-voltage d-c power in quantities of 50,000, 100,000, and 1,000,000 amperes from a single source. Based on the company's experience, a motor-generator set (one motor and one generator) larger than 10,000 amperes at 25 volts is not economically feasible. Very little change in the generator size and design would enable this machine to deliver 100,000 or more amperes at low voltage, the size of a homopolar generator being proportional more to the voltage than to the current capacity.



Although the new patented design is a recent development, electrical equipment manufacturers have built several homopolar generators with varying degrees of success. One serious fault of earli r homopolar designs is said to have been poor voltage regulat on.

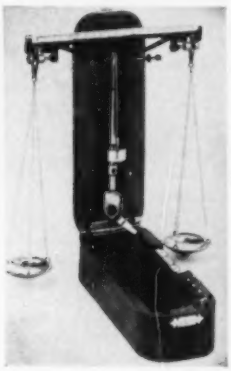
Basically the new design, improved and patented by J. V. Caputo, incorporates four features to make it commercially practical. They are: (1) Caputo compensation for minimum armature reaction

Equipment and Supplies

and good voltage regulation, (2) vertical design for easy maintenance, less floor space, and better cooling, (3) magnetic lift for reduction of thrust load on bottom bearing, and (4) water-cooling of brushes and collector rings for better heat dissipation and performance.

Outstanding advantages claimed are (1) pure direct-current power, (2) more amperes per unit floor space, (3) lower first cost, (4) less operating cost, and (5) reduced maintenance. For further information, use Reader Service Card.

E—424. Portable Analytical Balance—Designed for field work of all kinds, a new analytical balance, the Pocket Balance, has recently been introduced by Voland & Sons, Inc., New Rochelle, N. Y.



It has a capacity of 20 grams and can weigh up to 200 milligrams without small weights. Its sensitivity is 2 milligrams. For further information, use Reader Service Card.

E—425. Supersensitive Electronic Control of Temperature—A highly accurate and low-cost electronic control instrument No. 077 for industrial applications that is sensitive to temperature changes as small as one-tenth of one degree has been developed by Minneapolis-Honeywell Regulator Company.

The new device will control industrial processing temperatures within the temperature range of from 20° below zero to 300° above. It is said to be immune to vibration, dust and dampness and, where both control and a record are required, may be used with indicating or recording instruments made by Honeywell's Brown Instrument Division. For further information, use Reader Service Card.

E—426. Small Portable Stainless Steel Filter—Ferm Industries, Inc., 95 Wooster Street, New York 12, N. Y., now offers a 4-gal/min inexpensive welded filter for acid or alkaline plating solutions, said to be especially suitable for precious metal solutions and use in plating laboratories where a fine degree of filtration is required. Except for the 10-foot chemical hose and the filter pre-coat, the solution comes in contact only with stainless steel, including pump and 110–300 mesh woven-wire filter media. The filter is cleaned by back washing. The motor is a 110-volt, single-phase a-c unit. For further information, use Reader Service Card.

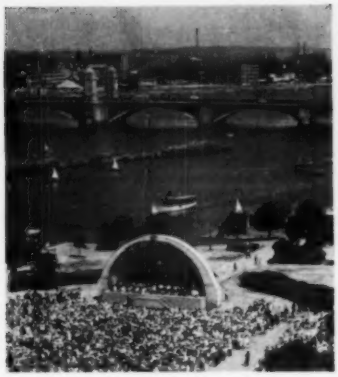
E—427. Black Oxidizing of Steel—Heathath Corporation, Springfield, Mass., offers a Controlled Oxidation Pentrate process and product, said to be simple to operate.

The product consists of two components. One package contains a granular mixture labeled Pentrate SS which is used in making the original bath and serves to replenish dragout losses. The second package contains compressed briquettes, Pentrate Brix. A combination of oxidizers, activators and inhibitors, they are used in small amounts to maintain constant oxidizing power and to eliminate many of the objectionable red and brown smuts usually encountered.

The bath operates within the wide temperature range of 265–315° F. Deep jet-black colors are imparted to steel very rapidly, in single or double baths. For further information, use Reader Service Card.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 133.

State Capitol



Esplanade Concert Hatch Shell

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Boston—Convention City

Few cities afford the fascinating diversity of Boston. As one walks the narrow, crooked streets or the unshaded walks of Boston Common one can feel the stirrings of three centuries of American history. Here is the site of the Boston Massacre and the Boston Tea Party. Across the Charles River in Charlestown is Bunker Hill which the red coats stormed while the patriots held their fire and Boston Navy Yard where the proud frigate, *The Constitution*, still floats after having been undefeated in forty engagements.

Not far from Boston are Plymouth Rock where New England history began and the sites of many early Pilgrim settlement and Colonial towns—Quincy, Weymouth, Hingham, Cohasset, and Scituate along the South shore; Lynn, Swampscott, Salem, and Gloucester along the North shore. In many of them the inhabitants still carry on the fishing trade of their forbears, catching cod or mackerel or lobster. Some have been taken over by artists and writers, others by vacationists, but all have preserved something of the early flavor. Inland from Boston are also towns with famous names: Lexington, Concord, and South Sudbury.

Boston is also a city of culture with few equals. The names of Emerson, Longfellow, Hawthorne and Thoreau are alive here. Still a literary city, Boston abounds in bookshops and outdoor book stalls in the old streets and has not less than 165 libraries available to the public. Besides the Public school system, it has more than 200 universities, colleges and other educational institutions, including, in Cambridge, the venerable Harvard University and Massachusetts Institute of Technology.

It is a musical city. Every music lover knows of the Boston Symphony, with its Pops concerts in Symphony Hall or on the Esplanade along the river every Spring and Summer, and of the famed New England Conservatory of Music. Art treasurers are found in up-town Boston by the beautiful Fenway Park with its Museum of Fine Arts and Gardner's Italian Palace.

The culinary arts are uncommonly well developed in this old city; fresh-from-the-ocean lobsters, clams and fish compete with delicacies eaten with chop sticks in the Chinese quarter, Near Eastern dishes, and the menus of French and Italian restaurants. Truly a place where the epicure constantly regrets the limit on his capacity.

While the proper Bostonian enjoys his culture, he works at industry and commerce. Boston harbor with its 30 miles of berthing space is known the world over. There are about 5,200 manufacturing plants and over 25,000 mercantile establishments within its metropolitan area. Rubber goods, razor blades and electrical apparatus are its most important output, but there is a great deal of diversification.

Many companies manufacturing are well known in plating circles—A. S. Campbell Company making automobile accessories, General Radio Company, Gillette Safety Razor Company, United-Carr Fastener Corporation, Waltham Watch Company—to mention only a few, and the city abounds in job plating shops.

The visitor will find much of interest when he goes to the A. E. S. Convention in June.

A. S. T. M.-A. E. S. SPECIFICATIONS FOR PLATED COATINGS

All numerical requirements refer to minima on significant surfaces.

Zinc on Steel: A164

Coating	Type G.S.	Type L.S.	Type R.S.
Zinc, inch	0.001	0.0005	0.00015

Cadmium on Steel: A165

Coating	Type N.S.	Type O.S.	Type T.S.
Cadmium, inch	0.0005	0.0003	0.00015

Nickel-Chromium on Steels: A166

Coating	Type D.S.	Type F.S.	Type K.S.	Type Q.S.
Copper plus nickel, inch	0.0020[a]	0.00125	0.00075	0.0004
Final nickel, inch	0.0010	0.0006	0.0004	0.0002
Chromium (if required), inch	0.00001	0.00001	0.00001	0.00001
Resistance to standard salt spray, hours without appreciable corrosion	96	72	48	16

[a]When copper is used in excess of a thickness of 0.0001 inch, its minimum thickness shall be 0.00075 inch.

Nickel-Chromium on Copper and Copper-Base Alloys: B141

Coating	Type F.C.	Type K.C.	Type Q.C.
Nickel, inch	0.0005	0.0003	0.0001
Chromium (if required), inch	0.00001[a]	0.00001	0.00001

[a]Maximum thickness should be kept below 0.00005 inch to prevent cracking.

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Nickel-Chromium on Zinc and Zinc-Base Alloys: B142

Coating	Type F.Z.	Type K.Z.	Type Q.Z.
Copper plus nickel, inch	0.00125	0.00075	0.0005[a]
Copper, inch	0.0004	0.0003	0.0002
Final nickel, inch	0.0005	0.0003	0.0003
Chromium (if required), inch	0.00001	0.00001	0.00001
Resistance to standard salt spray, hours without appreciable corrosion	48	32	16

[a]Total of 0.0003 inch if alternative of nickel only is used.

Lead Coatings on Steel: B200

Type	Copper inch	Lead inch	Salt spray Resistance[a] hours
E.S.	.....	0.0010	96
EE.S.	0.000015	0.0010	96
M.S.	.....	0.0005	48
MM.S.	0.000015	0.0005	48
P.S.	.....	0.00025	24
PP.S.	0.000015	0.00025	24

[a]To standard salt spray test in hours without appreciable corrosion.

Chromate Finishes on Zinc: B201

With two crossing, 1-inch long scratches through the chromate coating only, the part shall show no white corrosion visible to the unaided eye at normal reading distance after 24 hours in a standard salt spray test.

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A. E. S. News

Order of the Pot Organized

The Order of the Pot, which from time to time has been mentioned on these pages, has now been formally organized. As a result of its first meeting during the recent A. E. S. Convention in Milwaukee it now has both a Constitution and By-Laws.

The object of the Order, as stated in the Constitution, is to bind the Past Presidents of the Society into a group for the furtherance of the aims of the Society. The immediate object is to promote good fellowship among these distinguished gentlemen, and a further object is to provide a group of experienced leaders to whom the Executive Board may refer for counsel on problems of organization, policy, or finance.

Any Past President who has acquired a pot during his term of office as President is eligible for membership.

The pot may be acquired by

(a) presentation by a Branch visited during his term as President,
(b) talking his own Branch into presenting him with one, or
(c) stinkers preparing their own.

The specification for the pot provides that it shall be an electroplated metallic receptacle, of any convenient size, representative of skill in the art of electroplating. There shall be no leakage at the rivets, but the cavity need not be splash proof. The finish of the flange shall be smooth and nonabrasive. Added features may be equipment for winter heating, a tool holder, two handles for heavy loads, and a guard for the tool.

The presiding officer is called the Pot Wielder and the secretary the Pot Scriber. The present incumbents of these exalted offices are Walter L. Pinner and Kenneth M. Huston, respectively.

Annual dues collected from the members are used to defray the expenses of the Order. Monies in excess of $100 in the operating fund are placed in a reserve fund for a rainy day. Monies in excess of $100 in the Reserve Fund revert to a Welfare Fund for the promotion of the welfare of the Society, through cash prizes to stimulate acquisition of new active members of the Society, writing articles for the Society's monthly publication, or obtaining Sustaining Members to the Research Fund.

An appropriate membership certificate has been designed by Louis Orndorff, a Baltimore artist.

Charter membership in the Order was closed when a Charter Pot was presented to President Logozzo at the October meeting of the Baltimore-Washington Branch. This pot, made of 2S aluminum, is 5 inches in diameter by 4 inches deep and has a ½-inch flange. It was given an alkali etch, a zinc immersion coating, and a 0.0002-inch copper plate, polished and silver plated to 0.0003 inch, and then polished again; finally a portion of the inside was plated with 0.001 inch of bright cadmium. The single handle is of aluminum, gold plated over copper. A finishing-process legend sandwiched in plastic is attached to the handle with tin-plated resistance wire. The plating practices represented difficult production problems overcome during World War II. Like all pots it has the recipient's name engraved on the outside.

Charter Members and Charter Associate Members at the Organization Meeting of The Order of the Pot. Standing, left to right: Members F. K. Savage, K. M. Huston, S. S. Johnston, W. L. Pinner. Seated: Associate Members Mesdames S. S. Johnston, K. M. Huston, W. L. Pinner

President Logozzo receives Pot at Baltimore-Washington Meeting. Left to right: Honorary Members T. F. Slattery, William Blum, President Logozzo, Past Presidents K. M. Huston and F. Fulforth

Charter members of the Order, all of whom have been presented with pots by the Baltimore-Washington Branch, are Past Presidents Walter L. Pinner, Detroit Branch; Frank K. Savage, Chicago Branch; Kenneth M. Huston, Baltimore-Washington Branch; S. S. Johnston, Pittsburgh Branch; and President Logozzo, Hartford Branch.

Conception of the Order is credited to Walter Pinner. During World War II, while he was busy with plating problems connected with development of the atomic bomb, he arranged to present his boss with a fur-lined thundermug. The arrangements included the characteristic Pinner touch of inducing the boss's sec-

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INDICATE A 134.

retary to collect money to pay for the present, signing the contributors' names to a gift card, and finally presenting the gift at a large Christmas Party. Since the nature of the gift was unknown to the secretary, Mr. Pinner is still hiding from her. When Mr. Huston heard this story, he arranged with his Branch to present a silver plated pot to Pinner during his visit to the Baltimore-Washington Branch in February, 1946. The presentation address, made by Past President T. Slattery and couched in carefully selected phrases, so impressed Pinner that he provided a pedestal for his pot in his office in order that he may always be reminded that practical jokes have a way of following their perpetrator.

The official slogan of the Order is reported to be, "At least, we have a pot".

Gold Plating

Messrs. G. B. Hogaboom, Donald Wood, and E. A. Parker have been appointed a committee to investigate the situation arising from a Federal Trade Commission ruling on gold plating. Information on the outcome of this committee's activities will be published in PLATING.

A. E. S. Proceedings Out

With the excellent cooperation of the Editorial Board and the printer, the first of the 1949 *Proceedings* of the A. E. S. were mailed during the week of December 19. All copies were in the mails during the week of January 1.

1952 Exposition

The 1952 Industrial Finishing Exposition Committee, comprising C. Kelly, C. Nixon, H. Head and A. K. Graham, has recommended a site in Chicago for Executive Board approval. It is anticipated that this matter will be settled shortly, following which the initial promotional activities will get under way.

Address Wanted

The address of Walter J. Allen, Past President of the Society, is desired by the Executive Secretary. Please communicate with him at P. O. Box 168, Jenkintown, Pa.

Presidents' Certificates

According to decision by the Executive Board special certificates have been designed and distributed to all who have served as President of the Society.

Old Timers' Night

The New York Branch held an "Old Timers' Night" banquet on November 26 in honor of charter members of the A. E. S. forerunner, The National Electroplaters' Association, as we l as a number of other old timers. In all twenty-three members with their wives or daughters were guests of the Branch on this occasion.

The celebration was presided over by Branch President Milton Nadel who welcomed the guests and visitors and introduced the Master of Ceremonies, Mr. David X. Clarin, Eastern Division Manager of Oakite Products, Inc., and well known Branch Member. Mr. Clarin in his inimitable style in turn introduced the honored guests and gave resumes of their careers and achievements in the Society:

George B. Hogaboom, Hartford Branch, A. E. S. first president and past member of many committees, author of many papers, Proctor Award winner, honorary member of the Society

Horace H. Smith, Newark Branch, twice A. E. S. president, three times Convention Chairman, honorary member of the Society.

William Schneider, chairman of the Board of Managers and honorary member of the New York Branch, active in Society affairs and popular speaker at educational sessions

Thomas Haddow, Newark Branch, strong proponent of the Society and a foremost electroplater in the early days

Joseph Haas, former associate editor of THE MONTHLY REVIEW and "Brass World", chemistry instructor to early classes of the metropolitan group, former New York Branch vice-president

Royal F. Clark, Newark Branch, nationally known electroplater and leading activist of the Society's formative years, an early officer in the New York area

Justus Stremel, past president, member of the Board of Trustees for many years and honorary member of New York Branch

William Fischer, past president, trustee, and honorary member of New York Branch

William Voss, New York Branch officer and chairman of many committees

John E. Sterling, past president and member of many committees of the Society, long-time secretary and honorary member of New York Branch.

Thomas Trumbour, perennial secretary of the Good Fellowship Club, honorary member of New York Branch

Among thirty-five-year members of the Branch were Harvey Miller, Joseph Minges, Philip Morningstar, Elias Schorr and Ben Cross; among twenty-five-year members Ralph Liguari, John Rolph, Nat Fleet and A. E. S. Third Vice-President Franklyn J. MacStoker. All of them have made their mark in the Branch, the Society, or both.

All of the old timers responded to their introduction with remarks and anecdotes relative to early events, which aroused a great deal of nostalgic sentiment among the 125 members from New York, Newark and other Branches who were present.

All enjoyed the fine music, dancing and entertainment, including the superb show of magic by Paul Oldam of Newark Branch.

✝ ERNEST LAMOUREUX

Following the short announcement of Mr. Lamoureux's death in the November issue, additional data have been received from Mr. M. D. Rynkofs of Los Angeles.

Ernest Lamoureux was over seventy-nine years old at the time of his death, having been born in June, 1870 in Saint Angel, Quebec, Canada. An acute heart attack brought his life to an end on November 7 while he, in the company of his brother Remi, spent the evening in the home of friends teaching them Canasta.

In addition to Remi, who is also an oldtimer in the plating and polishing industry, Mr. Lamoureux is survived by his brother Alphonce of Dayton, Ohio and two sisters, Mrs. Rose Esary of Indianapolis, Ind., and Mrs. Alice Dilworth of Piqua, Ohio. His wife died in December, 1941.

The body lay in state at the W. A. Brown & Son Funeral Home where it was viewed by hundreds of his friends. Funeral services were held in the Church of the Precious Blood on November 12 and interment followed in Calvary Cemetery. Pallbearers were James W. Hanlon and Clarence E Thornton of Chicago, and Don Bedwell, Earl Coffin, E W. Francis and Marcus D. Rynkofs of Los Angeles. Among those who paid tribute to his memory was A. E. S. Executive Secretary Dr. A. Kenneth Graham who was visiting Los Angeles.

Mr. Lamoureux entered the plating industry at the tender age of nine after he and his parents had moved to Cincinnati, Ohio, and he remained active for fifty years. When he retired, in 1929, he was Midwest Manager for Hanson-Van Winkle-Munning Company. An interesting account of his "Early Plating Experiences" is found in the June, 1948 issue of PLATING.

An early member of the American Electroplaters' Society, Mr. Lamoureux gave much of his interest and energy to further its growth. He was one of the organizers of not less than five of its Branches, in Chicago, Milwaukee, St. Louis, Dayton and Grand Rapids. With the late H. W. Wilmore and Oscar Service he wrote the Society's first constitution, and he was one of the originators of the prize awards for convention papers and of the plated-ware exhibits at conventions. He also served as associate editor of THE MONTHLY REVIEW, now PLATING, in 1914. After he had retired, he became the elder statesman of the Los Angeles Branch and for many years was the chairman of its Board of Managers.

In recognition of his many services, Mr. Lamoureux was elected an honorary member of the A. E. S. in 1941, an honor which he cherished very highly. His name is forever engraved in the Society's annals.

Branch News

Coming Events

DAYTON BRANCH

FIFTH ANNUAL EDUCATIONAL SESSION AND DINNER-DANCE
Saturday, February 25
in Hotel Biltmore

Tickets from Paul Geske, 41 S. Bromfield Road, Dayton 9, Ohio. Telephone Wa 8-6351.

BALTIMORE-WASHINGTON BRANCH

The regular monthly meeting was held on December 13 at the Engineers' Club in Baltimore, with an attendance of thirty.

After a brief business session LIBRARIAN WALTER OLSEN introduced the speaker of the evening, MR. WALTER H. PRINE of The International Nickel Company, Inc. Mr. Prine gave an interesting and informative talk on nickel plating, with emphasis on heavy nickel deposits, building up of worn and overmachined parts, plating on nonconductors, and electroforming. Many interesting examples of this type of work were shown. The various types of nickel plating solutions best suited to individual applications and the physical properties of the deposits produced were described.

A social period followed adjournment, during which beer and soft drinks were served.

VERNON A. LAMB, Secretary

BOSTON BRANCH

At the meeting on November 3, PRESIDENT LOUIS V. GAGNON in the chair, reports were received from the By-Laws Committee, chairmen of the 1950 Convention Committees, and the Library Committee. One new member was elected. MR. DOWNES of Montreal, who visited Boston, addressed the group briefly. The Branch entered on its records that a prospective member had been born to ANNE BAKER LOVE and LOUIS J. LOVE, Ladies' and Finance Chairman respectively of the Boston Convention.

LIBRARIAN GLOVER then introduced DR. H. L. KELLNER of Lea Manufacturing Company, Waterbury, Conn., whose topic was "Evaluation of Polished Surfaces". Slides were used to illustrate all major points. Photomicrographs were shown of brass, aluminum, magnesium, and stainless steel, each polished with the same series of grades of material. Relations between smoothness and reflectivity were discussed together with "replica" determinations. A lively question period followed.

GEORGE P. SWIFT, *Secretary*

BRIDGEPORT BRANCH

Thirty-four members and guests were present at the regular monthly meeting on November 4, when one new member was elected and one membership application was received.

RAY GORAL, a member of the Projector Committee, reported that a Model B Bausch and Lomb "Balopticon No. 67245" and a 50x50-inch Radiant Screen had been purchased for a total of $76.35 plus State tax.

WILLIAM N. LINDSAY, JR., Chairman of the Sick Committee, reported that MR. MITCHELL, father of our member ABRAHAM J. MITCHELL, has passed away. The Branch members had expressed their regret and sympathy with a floral offering.

After considerable discussion, it was decided to rejoin the Regional Meeting permanently, providing the Branch does not have to pay out more money than it received when it withdrew, namely $200.00.

PHIL BAILIN had arranged to have pictures shown entitled "The Making of Steel". They proved very interesting.

Refreshments were served through the courtesy of MR. AXELROD of the M. E. Baker Company, Boston, Mass.

JOSEPH G. STERLING,
Secretary-Treasurer

CHICAGO BRANCH

On December 9 thirty-five members and guests were present for the dinner, with one hundred in attendance at the meeting which followed.

MR. C. F. NIXON, Process Engineer of the Ternstedt Division, General Motors Corporation, Detroit, talked on the subject, "Your American Electroplaters' Society", and MR. LEONARD WEEG of National Lock Company, Rockford, Ill., spoke about "The National Research Program". The two speakers contributed greatly to the general knowledge of the numerous activities of the Society and its contribution to the industry.

Following the educational session a buffet supper was served.

R. F. LEDFORD, *Correspondent*

CINCINNATI BRANCH

The regular meeting for November was held on the 16th, one week earlier than usual to avoid Thanksgiving week.

The meeting began with a turkey dinner at 6:30 P. M., after which two reels were shown of movies on fishing and football that proved very interesting.

The feature of the evening was a presentation of the Roto-Finish Process by MR. A. R. HATFIELD, Field Engineer, and C. H. CASTLE, Technical Director, of the Roto-Finish Company, Sturgis, Mich. The presentation was in the form, principally, of movies taken in their plant, explained by one of the speakers. A discussion session followed.

The refreshments after the meeting were

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INDICATE A 135.

provided by The Merchants Chemical Company. There were thirty-six present for the dinner and forty at the meeting. Four new members were received.

H. R. Davis, *Secretary*

CLEVELAND BRANCH

The December 2 meeting featured a lecture by a member who had recently moved to this section, Mr. E. J. Roehl of Thomas Steel Company. Mr. Roehl spoke about the formation and structure of electrodeposits and about their relationship to physical properties such as density, porosity, and reflectivity. The members present were most interested in the ideas presented concerning crystal growth and orientation and how they, along with other factors such as gas entrapment and inclusion of colloidal or basic cathode products, cause the intrinsic porosity of electrodeposits.

During the business session, President Ed. Friedl appointed Harvey Heil Chairman of the new Nominating Committee and urged that the Branch formulate a set of By-Laws. First Vice-President L. N. Elicker announced that he would shortly send to each member a questionnaire soliciting information about prospective new active members and sustaining members.

Refreshments were served after the meeting.

Harry Pochapsky, *Secretary*

DAYTON BRANCH

There was no regular meeting during the month of December; instead, a Christmas Party was held at the Paradise Gardens. This turned out to be a grand affair, with ninety persons present for dancing, card playing, refreshments, and an exchange of gifts. We wish to thank Frank Klein, Ralph Clinefelter, and Herman Austen for their fine work in arranging it.

Our next big social affair will be the Fifth Annual Educational Session and Dinner-Dance on February 25 which promises to top them all.

R. M. Clinehens, *Secretary*

DETROIT BRANCH

An excellent crowd, estimated at one hundred and fifty members and guests, was present at the meeting on November 4.

The Membership Committee, which had been very active during the preceding month, presented names of eight persons for membership, all of whom were elected.

The high spot of the evening was a paper on Society affairs by President Cleveland Nixon, who is also the Second Vice-President of the Society. Mr. Nixon made an admirable presentation showing the position of the Society and its research activities in regard to growth and financial condition. The meeting was adjourned at 10:30 P. M. to allow time for the members to partake of refreshments.

F. J. Newton,
Educational Chairman

DETROIT BRANCH

The Branch held its Annual Educational Session and Dinner on December 3. As is usual, a large number of out-of-town guests were present, headed by the complete line-up of the Society's Executive Officers.

The Chairman for the afternoon session (at which approximately two hundred members and guests were present) was A. E. S. President Arthur W. Logozzo, who introduced distinguished visitors, including at least four past presidents of the Society and Dr. W. Blum of the Bureau of Standards.

The technical paper for the afternoon, by Messrs. W. M. Phillips and F. L. Clifton of the General Motors Research Division, dealt with "Instrumentation". Mr. Phillips' talk was profusely illustrated with slides showing the types of instruments which are available to the plating industry and what they would do for the plater. He pointed out, however, that the most important "instrument" in the plating industry is the plater's brain.

After a brief question period, Mr. Logozzo turned the meeting over to Fred Wagner who introduced Major General Stanley Reinhardt of the U. S. Army. General Reinhardt's talk, in which he stressed the importance and necessity for military preparedness as a deterrent to war, was very well received.

The meeting was adjourned at 4:15 P. M. to allow the members present to view an exhibit of plating instruments which had been prepared under the direction of Joseph Gurski of the Ford Motor Company. It was arranged so that every one could visualize how such equipment could be used in his own shop.

The Dinner-Dance at approximately 7:00 P. M. brought 1,250 people, who enjoyed a very lovely dinner and an exceptionally fine floor show under the chairmanship of Robert L. Redman of the Automotive Rubber Company. The usual refreshments supplied by members were available. The party lasted until the wee hours of Sunday, whereupon everyone wended a weary, but happy, way home.

F. J. Newton,
Educational Chairman
W. P. Innes,
Asst. Secretary-Treasurer

HARTFORD BRANCH

The annual Christmas Party and Ladies' Night was held on December 12. Approximately eighty-five people enjoyed the interesting program of the evening.

Musical selections were played by Mrs. Ralph C. McCahan, violinist of the Hartford Symphony Orchestra, accompanied on the piano by Mrs. Harry Sanders. Miss Julie Majkowski, Chairwoman of the evening, introduced Mrs. Edrie Van Dore, Woman's Editor of the Hartford *Times*, who spoke on the subject, "Fashion as an Industry". She presented an informal talk on how the clothing and fashion industry operates. Mr. Carlton Bearse, Springfield, Mass., then gave an interesting talk on "Three Dimensional Photography". Each person present was given a Polaroid lens to view pictures shown on a screen to illustrate the third dimension.

Dancing followed to the music of Paul C. Landerman's orchestra until 1:00 A. M. During intermissions E. M. Stephenson, Honorary Member, entertained with cutting of silhouettes.

Entertainment was furnished through the courtesy of the W. D. MacDermid Chemical Company, The Chemical Corporation and the Nutmeg Chrome Corporation.

Stanley Platoz, *Secretary*

LANCASTER BRANCH

The November meeting on the 11th consisted of a visit to the Alphonse Knoedler Manufacturing Company, a dinner at Dissinger's Inn, and a talk on the finishing of watch dials by the world-famous Hamilton Watch Company by our own William Fordney.

In the Knoedler plant we saw the moulding of umbrella handles and allied products in plastic and their subsequent plating in defined areas, resulting in a product of nearly unbelievable beauty. After a dinner and a short business meeting we had described to us in detail the many intricate processes which go into the production of a fine watch dial. It was an interesting and unusual day in that one had the opportunity to observe and to listen to fellow members of the Branch.

Chester W. Smith,
Secretary-Treasurer

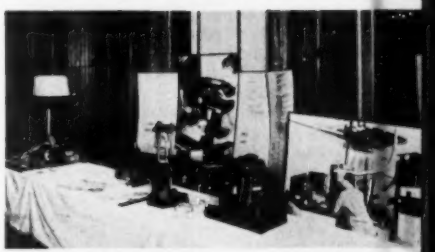
LOS ANGELES BRANCH

A regular dinner meeting was held in Scully's Restaurant on November 9. Eighty-nine members and guests attended, among the latter George Vendes of Cadmium and Nickel Plating Company; Ralph Reeves of U. S. Naval Ordnance Test Station; Robert Streeton of Turco Products, Inc., and Melvin Sydenstricker of Acme Plating Company.

Nine new members were initiated before the speaker of the evening, A. E. S. Executive Secretary Dr. A. Kenneth Graham, delivered an interesting and highly informative illustrated talk on the "Plating of Copper and Zinc Alloys". A lively discussion period ensued.

The membership was grieved to learn of the sudden passing of Ernest Lamoureaux, one of the oldest members of

DETROIT BRANCH EDUCATIONAL SESSION



Reading clockwise:

F. J. Newton, Branch Educational Chairman, welcoming members and guests

Branch President C. F. Nixon mikes main speaker, W. M. Phillips

Meeting Chairman, A. E. S. President A. W. Logozzo

From the Plating Instrument Exhibit

Joseph Gurski, who arranged the Exhibit

Major-General Stanley Reinhardt, the second speaker

the Los Angeles Branch and one of the founders of the Chicago Branch.

Branch officers and committee chairman for the 1951 Los Angeles Convention met in the Biltmore Hotel on November 8 with Dr. Graham to discuss preparations for the 1951 convention.

M. H. Orbaugh, *Secretary*

LOUISVILLE BRANCH

On November 17 the members gathered as usual in Speed Scientific Building, University of Louisville.

Following a discussion, President Albert Steidle appointed C. H. Pate, Thomas K. Allison, and Stanley Beyer a committee to investigate two new locations for meetings and to make recommendations at the next meeting.

Mr. G. A. Cummings of Frederic B. Stevens, Inc., spoke on the subject, "Selection of Motor Generators and Rectifiers for the Plating Room". In presenting the pros and cons in the light of plating requirements, he set up scales of costs, efficiencies, types of service, types of load and overload, flexibility, maintenance, and floor-space requirements by which the plater should judge his purchases of current sources.

As usual, the speaker was bombarded by questions, both general and specific, which he answered successfully despite the fact that so much controversy exists.

S. J. Beyer, *Secretary*

MELBOURNE BRANCH

Thirty-six members and visitors attended the November regular meeting to hear an address on "Plating on Aluminum" by Mr. R. H. Keller of the Defence Research Laboratories.

The speaker explained the inherent difficulties in the plating of aluminum in terms of the high position of the metal in the electrochemical series, which causes most metals to deposit by immersion. Another disadvantage is the quick formation of an oxide film on the surface under oxidizing conditions. He traced the development of the various pretreatment methods from the heavy-metal dips down to the zincate or anodizing methods in favor today. The zincate method was recommended as the most practical for ordinary purposes, and the various steps in the method were described in detail. Knowledge of the type of aluminum alloy being treated is important as the method needs to be varied slightly to suit certain alloys.

The interest of the audience was evidenced by the diversity of questions asked during the discussion period.

John J. Dale, *Hon. Secretary*

MONTREAL BRANCH

Mr. Walter H. Prine of The International Nickel Company spoke before an audience of thirty-seven members and guests at the regular monthly meeting on December 6.

Librarian P. M. Coady introduced the speaker, whose subject was "Industrial Nickel Plating". This subject covered plating baths and conditions of plating, as well as applications of the plate. Plating troubles were analyzed and the probable cause given. A question period followed.

Mr. Ken Clark of The International Nickel Company announced a new magazine,"Nickel Plating", which is published by The International Nickel Company of Canada, Ltd.

During the business session which followed, a nominating committee was appointed consisting of J. G. Carrique, Chairman, G. R. Davidson, W. Glover, C. Douglas, and J. J. Roche. J. H. Charles was appointed to cooperate with Mr. MacStoker in connection with the Plated Ware Exhibit at the Boston Convention.

J. J. Roche was thanked for his efforts in bringing guests to the meeting. Three new members were elected.

George R. King,
Secretary-Treasurer

NEWARK BRANCH

At the regular meeting on November 4, with sixty members and guests in attendance, five membership applications were received.

Mr. Milton Nadel, New York Branch President, extended a personal invitation to our group to attend the "Twenty Year or More Club" testimonial dinner to be given in the Hotel Statler, New York on November 26. Complimentary tickets were presented to Horace Smith and Thomas Haddow.

Librarian Robert Ehrhardt introduced Mr. A. Bignall, Sales Engineer, Lasalco, Inc. Speaking on the subject of "Barrel Plating", he discussed the changes in barrel design through the years, how to load a barrel properly for maximum efficiency, and computation of thickness of plate. A color movie aided the speaker in showing the way to load a barrel depending on the type of work to be plated. As an added feature was a color movie film of the Grand Canyon taken by Mr. Daw, President of Lasalco. It revealed nature's handiwork in all its glory, both in color and contour.

A Question-and-Answer Period followed. (See Question Box in this issue.)

Samuel Frey, *Recording Secretary*

NEWARK BRANCH

Not less than six applicants were elected to membership at the meeting on November 18. One member transferred to the New Haven Branch, and there were three membership applications.

The speaker for the evening was Dr. F. D. Snell of F. D. Snell, Inc., who spoke on the subject of "Detergency and Surface Activity". Several examples of commercially available anionic, cationic, and nonionic surface-active agents were given. A brief history of the use of surface-active agents was traced, from ancient to modern times. It was interesting to note that over 800 surface-active agents have been prepared, with about 30 different types of chemical structure. Reaching high concentration at interfaces, they disperse soils, form miscelles, and wet surfaces. Fats and petroleum are the two chief sources for the manufacture of surface-active agents, the production of which will amount to about one-half billion pounds this year. Numerous applications were cited, such as in the compounding of lubricants for high-compression engines and rolling mills operation; in bakery goods; in sanitizing materials; in cosmetics; in emulsion breakers for oil wells; and in spinerette cleaners used in the rayon industry. A considerable number of questions were asked which Dr. Snell answered in an amicable fashion.

To top off the evening, two films were shown. One depicted the manufacturing of wrought steel in early times and now; the other brought thrills and spills with horses, tanks, boats, and motor cars.

Refreshments were served, with most of the crowd remaining until 11:30 P. M.

Samuel S. Frey, *Recording Secretary*

NEW YORK BRANCH

The meeting of November 11 saw the election of three more persons to membership in this Branch.

The seventy-three members present were informed of the "Old-Timers' Night" Banquet scheduled for November to do honor to the Society's pioneers. Report was made of progress in the preparations for the Annual Educational Session and Banquet to be held in February.

Librarian Derrick Hartshorn conducted a Question Bee which enlightened and educated the participants to what they should know about plating.

Albert Fusco, *Recording Secretary*

NEW YORK BRANCH

Three new applications for membership were received at the meeting on November 25.

Among the guests was Mr. Edwin Bowerman, President of our neighbor the Newark Branch, who besides getting in a bit of a commercial for their affair in December, was surprised to learn where some of the Newark Branch members spend their Friday nights.

Marking the evening as unforgettable was our speaker of the evening, Mr. R. O. Hull of R. O. Hull & Company, Cleveland, Ohio, whose topic was "New Ideas in Plating Control". The attendance of sixty-five members the day after Thanksgiving was a tribute to the speaker and speaks well of the interest in his subject.

The usefulness of the Hull cell for supplementary analysis, particularly for control of sulfate-ratio in chromium baths and of brighteners and impurities in bright-plating baths, indicates that this tool is a necessary adjunct to modern plating control. Some interesting cases of the peculiar behavior of chromium baths were described, as well as the effects of nickel bath variations upon subsequent chromium plate. Plating over rainbow staining results in the well known white smears, corrected by raising the sulfate content.

Numerous other bits of vital information and ingenious uses of the Hull cell kept the members interested until the meeting adjourned at 10:30 P. M.

ALBERT FUSCO,
Recording Secretary

PHILADELPHIA BRANCH

Twenty-eight members and guests were present on December 9 when MR. CLARENCE H. SAMPLE, The International Nickel Company, New York City, spoke on "Specifications and Tests for Electrodeposited Coatings". He covered the history of plating specifications and described in detail the tests in use for determining thickness, porosity, adhesion, hardness, ductility, appearance, lustre, electrical and magnetic properties, and stress. Mr. Sample's talk was well presented and illustrated with slides.

TREASURER GEORGE M. LONG reported that the Banquet on November 19 had been a financial as well as educational and social success, a higher profit being indicated than from the 1948 affair.

MR. EDWIN OTTENS gave the concluding talk in his series on brighteners and brightening. Dealing with "Theory of Brightening by Organic Addition Agents" he covered such brightening phenomena as the formation of bright nickel deposits.

The door prize, a pair of bronze book ends donated by Hillside Manufacturing Company, Hillside, N. J., was won by Burton White.

Two new active members were admitted.

I. WM. MARCOVITCH, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

The Christmas Party on December 12 was the first topic of discussion at the business meeting on November 14. JERRY NOONAN had come up with an excellent program for the evening.

The school program was then discussed from every angle, and it was decided to attack its faults from two directions. The first calls for more personal contact work with the individuals in the plating rooms and the second for integration of the courses now given and their expansion by means of visual aids: demonstrations, movies, more written material.

To PHIL CLARNER was delegated the

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task of developing a useful directory of the members for their own use.

The regular November meeting was held on November 21 in the Sheraton-Biltmore Hotel. MR. LOWELL MCCOY of the Research Division of Wyandotte Chemicals Corporation discussed the broad aspects of "Barrel Finishing". The two major divisions are burnishing and deburring, or cutting down. The first involves mainly smoothing of the surface with little or no removal of metal. The latter usually employs stones (of several types) and removes considerable metal. The lengthy discussion which followed pointed up the fact that each item requires its own individual treatment. Some expect a burnishing medium to handle several metals at once and to treat all alike. Others use it for a week. Still others "cut and gloss" in the same tub, etc.

The resignation of SECRETARY IRV EASTMAN was regretfully accepted as he has left the plating field.

EDWARD A. PARKER,
President

PITTSBURGH BRANCH

The regular December meeting was given over to a social gathering in the Avalon Room of Hotel Sheraton. This meeting was exceptionally well attended by members and their guests, an estimated eighty-five persons being present.

MR. FRANK GRUBBS of the Weirton Steel Company, Weirton, W. Va., showed a movie of the production of tinplate. S. S. JOHNSTON presented Mr. Grubbs to the Branch, and later answered several questions concerning the movie. He also introduced A. E. S. FIRST VICE-PRESIDENT W. J. NEILL as an honored guest.

Door prizes were given, an orchid to a lucky lady, a cigarette lighter to a guest, and a membership pin to JOHN F. LOHR, a member.

The Librarian's Committee, headed by DR. LANCY who was ably assisted by MESSRS. R. A. WOOFTER, R. E. GEUDER and ED WASHBURN, deserves the thanks of the Branch for a well planned and very successful evening.

E. J. SMITH,
Secretary

ST. JOSEPH VALLEY BRANCH

Thirty-three members and guests were present for the dinner and social hour, and fifty attended the technical session on December 7.

After six guests had been introduced, two applicants were elected to membership and one new application for membership was presented.

The death of WORTH W. MATHEWS was reported by JOHN LOCKERBIE. The Branch resolved to send a note of sympathy to his family.

The Research Committee Chairman, DR. HAROLD WIESNER, made a report on the Research activities and the need for sustaining members. He appointed the following members to assist him: PROCTOR MOORE, CHESTER MCDOWELL, MALCOLM ANDERSON, GEORGE BOCK, JR., and JOHN LOCKERBIE.

The speaker for the evening was MR. H. J. STRUCKHOFF, Vice-President of Lasalco, Inc., St. Louis, Mo. His paper on "Barrel Plating" dealt with what happens in a mechanical plating barrel and laid particular emphasis on the care necessary in computing loads to control the plating area, distribution of the load, weight of the load, and plating time. He discussed the difficulties encountered with over- or under-loading of barrels and the use of proper speeds of rotation. The talk was illustrated with a moving picture, which showed the actual operation of the barrel and the behavior of the work load during the plating operation.

At the end of his talk Mr. Struckhoff gave a report on the A. E. S. Research Committee activities. The film, "Lot's Wife", concluded the session.

EUGENE ROTH,
Secretary-Treasurer

San Francisco Branch holds its Annual Christmas Party, at Club Lido in San Francisco on December 10.

ST. LOUIS BRANCH

The December meeting was held on the 14th in York Hotel. Forty-five members answered present to the roll call. Our President handled the business of the evening due to the absence of our Librarian who had been called out of town. There were four applications for membership.

For the past eight months the Entertainment Committee has been trying to get a program for one of our meetings and finally the month of Dec mber had been decided upon. At the close of the evening all thanked the committee for the fine show for which it was responsible.

EDWARD HUNLETH,
Secretary-Treasurer

SAN FRANCISCO BRANCH

In lieu of the regular monthly meeting the Branch held its annual Christmas Party at Club Lido in San Francisco on December 10.

The Dinner-Dance arrangements were under the able Chairmanship of R. J. PATTENGER. He and his committee had arranged an evening of fun and celebration, climaxed by a drawing of many prizes which had been donated.

JOHN J. MEEHAN, *Secretary*

SYDNEY BRANCH

The fifty-eighth meeting on October 11 in Manufacturers House, with thirty members and visitors in attendance, had for its main topic of discussion the adjustment of the yearly dues to the devalued pound. It was finally decided to fix the dues at £3.3.0, which means that the Branch will be forced to operate on a smaller margin.

The speaker was MR. J. FOWLER of Australian Durex Products, who lectured on the use of "Backstand Idlers and Abrasive Belt Polishing". He also gave us a short description of the method of manufacture of the belts and illustrated his talk with drawings. The lecture was voted one of the best yet, and the lecturer was called upon to answer a number of questions.

T. O. KOLTS,
Secretary-Treasurer

SYDNEY BRANCH

The fifty-eighth regular meeting on November 7 had an attendance of more than thirty members. After correspondence had been read and general business transacted the main business for the night, the election of officers, was conducted with the following results:

President—W. PATTERSON
First Vice-President—F. BELLENGER
Second Vice-President—
D. A. CARPENTER
Librarian—J. MUTCH
Secretary-Treasurer—H. COATES
Board of Managers—E. WRIGHT, J. GODFREY, M. REEVES

The Librarian conducted the Question Box which produced a lively discussion.

T. O. KOLTS, *Secretary-Treasurer*

SYRACUSE BRANCH

The December meeting was a Christmas Dinner Party held at H. Moran's Restaurant on the 14th.

Seventy-five members and guests, including the wives and lady friends of the members, enjoyed a fine dinner and a most pleasant evening of good fellowship. Thirty-one handsome door prizes were presented to the lucky ticket holders by generous suppliers.

K. S. PARNELL, *Secretary-Treasurer*

TOLEDO BRANCH

The regular monthly meeting on November 3 was held in the offices of the Vic. Miner Company. The following were appointed to serve on the committee for the Christmas Party in Commodore Perry Hotel on December 1: CHARLES VANNORSDALL, BEN GOMMERSAL, WALTER WEIKER, JOHN STEGEMAN and JOHN BANTA.

DR. D. G. FOULKE of the Hanson-Van Winkle-Munning Company, Matawan, N. J., gave a very interesting slide-illustrated talk about the periodic reverser and its use with copper solutions. We sincerely hope that Dr. Foulke who burned his hand quite badly in line of duty while in Toledo has recovered by now.

An excellent lunch with refreshments was served through the courtesy of the Vic. Miner Company.

G. P. H. BERGEMAN, *Secretary*

SOUTHEASTERN BRANCH

The regular monthly meeting on December 9 had an attendance of twelve members. Two new members were elected.

A meeting in Jacksonville, Fla., for the month of March was discussed and tentatively agreed upon. DR. FRED COX, Branch Research Committee Chairman, showed the A. E. S. slide film, "Lot's Wife". PRESIDENT H. R. WAGNER stressed the need for sustaining members in the South. We hope to obtain at least a few in the near future.

WM. T. WEYMOUTH,
Secretary-Treasurer

TWIN CITY BRANCH

Thirty members and guests attended the dinner meeting on October 3.

Following the introduction of guests by C. A. BOWMAN of Minneapolis Honeywell Regulator Company, MEMBERSHIP CHAIRMAN and PAST PRESIDENT FRANK IRELAND of Brown and Bigelow, Inc., urgently requested each member to strive to obtain more members. A discussion was held about having question cards which may be completed by those attending the meeting for answer by the speaker or another member.

Following dinner, MR. HAROLD W. FAINT of Industrial Filter and Pump Manufacturing Company, Chicago, spoke about "The Application of Ion Exchange in the Plating Industry". Mr. Faint's talk was both interesting and informative.

ROBERT L. BUCKLEY,
Secretary-Treasurer

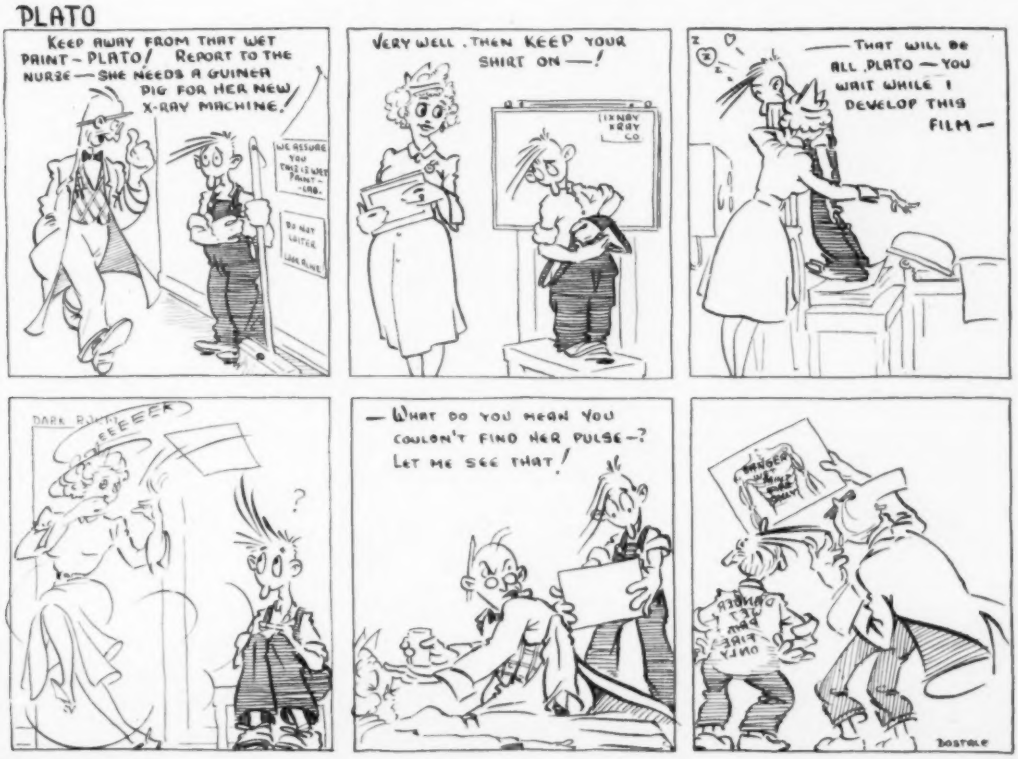
TWIN CITY BRANCH

There were thirty-six members present at the meeting on November 7. Through the courtesy of the Green Electric Sales Corporation they enjoyed a round of refreshments before dinner.

In the absence of PRESIDENT CLIFF BOWMAN, VICE-PRESIDENT AL JOYNER, SR., introduced the several guests. DR. FRANK IRELAND, Past President and Membership Chairman of the Branch, stressed the urgent need for new members.

LIBRARIAN GUNNAR DEEDON introduced MR. L. W. "LOU" REINKEN, Chief Engineer of Green Electric Sales Corporation, who spoke about plating rectifiers and their applications. Mr. Reinken's talk was followed with interest and considered one of the most absorbing talks on plating equipment presented to the Branch. Following his talk, Mr. Reinken was given a small token of appreciation.

ROBERT L. BUCKLEY,
Secretary-Treasurer


PLATO
KEEP AWAY FROM THAT WET PAINT - PLATO! REPORT TO THE NURSE — SHE NEEDS A GUINEA PIG FOR HER NEW X-RAY MACHINE!
WE ASSURE YOU THIS IS WET PAINT — LMD.
DO NOT LOITER
VERY WELL. THEN KEEP YOUR SHIRT ON —!
IXNAY KRAY CO
— THAT WILL BE ALL, PLATO — YOU WAIT WHILE I DEVELOP THIS FILM —
DARK ROOM
EEEEEK
— WHAT DO YOU MEAN YOU COULDN'T FIND HER PULSE —? LET ME SEE THAT!
DANGER
DANGER
ONLY
Bostelo

Membership Report of the A. E. S.

Elections

BRIDGEPORT BRANCH: Daniel D. Zielik

CLEVELAND BRANCH: William C. Kranich

HARTFORD BRANCH: V. Chester Hickey, Thomas P. McFarlane

JACKSON-LANSING BRANCH: Joseph Czernecki

MELBOURNE BRANCH: L. M. Barnes, J. N. Parker, W. Mann

MONTREAL BRANCH: Louis Foley, L. A. Robillard, C. E. Shutt

NEW HAVEN BRANCH: Robert Williams

NEW YORK BRANCH: Raymond Buttacavoli, Jack Greenwald, Stanley J. Klima, William H. McAllister, Seymour Rosenberg, Henry Suss

PHILADELPHIA BRANCH: Walter G. Bonuef, Albert R. Uhl

PITTSBURGH BRANCH: John C. Gade, Joseph L. Kelley, Robert E. Varner

ST. JOSEPH VALLEY BRANCH: Edwin C. Fechrer, Robert Whitmer

ST. LOUIS BRANCH: Edward Dutchmaneck, Edward Faltyn, Eugene K. Mueller, William Sullivan

SAGINAW VALLEY BRANCH: William A. Zube

SOUTHEASTERN BRANCH: Thomas W. Cowan, Jr., E. P. Cofield, Jr.

TOLEDO BRANCH: Joseph F. Gorman

WATERBURY BRANCH: John H. Leever, Frank E. Smith

Reinstatements

CHICAGO BRANCH: Alex Piscator, Robert E. Towner

DAYTON BRANCH: John P. Roberts

HARTFORD BRANCH: Daniel Tocc

MONTREAL BRANCH: E. H. Marsh

TOLEDO BRANCH: Frank Hearn, Frank Hearn, Jr.

MEMBERSHIP-AT-LARGE: P. Bayens, Charles C. Pearce

Transfers

Carleton H. Deuter from Bridgeport Branch; J. H. Schneider from Chicago Branch; John K. Werner from Hartford Branch; Herbert Millwater to New York Branch

Resignations

MELBOURNE BRANCH: T. Clancey, L. Overell

PROVIDENCE-ATTLEBORO BRANCH: Benjamon Perkoski

Suspensions

CHICAGO BRANCH: Philip S. Ander-

(*Continued on page 202*)

Membership Competition

BRANCH	Membership April 1, 1949*	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
DETROIT	427	67	+52½	+12.3
NEW YORK	265	27	+17½	+ 6.6
HARTFORD	133	10	+ 4	+ 3.0
PITTSBURGH	135	22	+ 3½	+ 2.6
CLEVELAND	186	18	+ 2	+ 1.1
PHILADELPHIA	187	17	+ 2	+ 1.1
GRAND RAPIDS†	160	..	.....	.....
BRIDGEPORT	160	6	− 3½	− 2.2
LOS ANGELES	217	18	−11	− 5.1
CHICAGO	391	19	−26½	− 6.8
NEWARK	256	17	−20½	− 8.0
MILWAUKEE	132	9	−13	− 9.8
BOSTON	153	8	−16	−10.5
TORONTO	154	6	−17½	−11.4
SECOND GROUP				
MELBOURNE	81	24	+19	+23.4
BUFFALO	82	6	+ 6	+ 7.3
CINCINNATI	90	7	+ 5½	+ 6.1
SYDNEY†	108	8	+ 1	+ 0.9
SYRACUSE	83	6	+ ½	+ 0.6
WATERBURY	122	5	+ ½	+ 0.4
PROV.-ATTLEBORO	109	3	− ½	− 0.5
BALTIMORE-WASH.	83	7	− ½	− 0.6
INDIANAPOLIS	104	9	− 2	− 1.9
NEW HAVEN	108	3	− 4½	− 4.2
DAYTON	98	3	− 6½	− 6.6
ST. LOUIS	107	11	− 8	− 7.5
ROCHESTER	125	..	−20½	−16.4
ST. JOSEPH VALLEY	80	4	−15	−18.8
THIRD GROUP				
SOUTHEASTERN	38	16	+10½	+27.6
LOUISVILLE	20	5	+ 3½	+17.5
ROCKFORD	56	8	+ 8	+14.3
COLUMBUS	38	7	+ 2½	+ 6.6
SPRINGFIELD	50	2	+ 2	+ 4.0
LANCASTER	59	3	+ 2	+ 3.4
MONTREAL	69	11	− ½	− 0.7
JACKSON-LANSING	59	3	− 3	− 5.1
SAGINAW VALLEY†	67	4	− 5	− 7.5
TWIN CITY	77	4	− 8	−10.4
ADELAIDE	76	4	− 8	−10.5
TOLEDO	56	2	− 6½	−11.6
SAN FRANCISCO	71	16	−11	−15.5
ALLENTOWN-READING	43	1	−10½	−21.4
OUTSIDE COMPETITION				
HAMILTON	...	14	+20	.....
WESTERN ONTARIO	...	19	+19	.....
AT LARGE	100	23	+ 3	.....
IN TRANSFER	22	...	− 2	.....
TOTAL A. E. S.	5,237	480	−50	− 1.0

Active Membership, January 1, 1950 5,187

*Subject to correction. †Winners of membership competition in 1948–1949.

SUSTAINING MEMBERSHIP LIST

As of January 1, 1950

(Figures in parenthesis indicate number of memberships held)

Acme Plating Company, The
Acme Steel Company
Advance Plating Company, The
Alsop Engineering Corporation
Aluminum Company of America
American Brass Company
American Buff Company
American Can Company
American Chemical Paint Company
American Hot Dip Galvanizer's Association, Inc.
American Instrument Company
American Radiator and Standard Sanitary Corporation
American Smelting & Refining Company
American Wire Fabrics Corporation
American Zinc Institute (5)
Apex Plating Company
Apothecaries Hall Company
Ardco, Incorporated
Armco Steel Corporation
Arrow-Hart & Hegeman Electric Company
Auto City Plating Company
Automotive Rubber Company
Azed, Inc.
M. E. Baker Company
Bastian-Blessing Company, The
Belke Manufacturing Company
Bell Telephone Laboratories, Inc.
Berteau-Lowell Plating Works
Bethlehem Steel Company (2)
Blakeslee, G. S. & Company
Brown-Hutchinson Iron Works
Buckingham Products Company (2)
Canadian Hanson & Van Winkle Company, Limited
Casco Products Corporation
Chase Brass & Copper Company
Chemical Corporation, The
Chicago Electro-Platers Institute
Christie Plating Company
Chrome-Rite Company (2)
Chromium Corporation of America
Chromium Process Company, The
Chrysler Corporation (2)
Cinch Manufacturing Corporation
Cleveland Graphite Bronze Company, The
Clinton Company, The
Codman, F. L. & J. C., Company
Corona Corporation
Cowles Chemical Company
Cronamc, Incorporated
Crown Cork and Seal Company
Crown Rheostat and Supply Company
Darco Corporation
Davies Supply & Manufacturing Company
Daystrom Corporation
Detrex Corporation
Detroit Plating Industries
Dixie Electro Plating Company
Doehler-Jarvis Corporation (2)
R. R. Donnelley & Sons Company
E. I. du Pont de Nemours & Company (2)
Dura Div., Detroit Harvester Company
Dura-Chrome of Chicago, Inc.
Eastman Kodak Company
Eaton Manufacturing Company
Electric Auto-Lite Company, The (2)
Electrolux Corporation
Ellmore Silver Company, Inc.
Enthone, Inc.
Erie Plating Company
John H. Feeley
Finishing Publications, Inc.
Ford Motor Company (5)
Formax Manufacturing Company
Frigidaire Division, General Motors Corporation
Gemex Company
General Electric Company
General Motors Corporation (5)
Gerity-Michigan Corporation
Gillette Safety Razor Company
Gorham Manufacturing Company
Graham, Crowley & Associates, Inc.
Graham Plating Works
Great Lakes Industries, Inc.
W. Green Electric Company, Inc.
Frederick Gumm Chemical Company (2)
Hamilton Watch Company
Hammond Machinery Builders, Inc.
A. H. Hannon
Hanson-Van Winkle-Munning Co. (3)
Harshaw Chemical Company, The (3)
Haviland Products Company
Heil Process Equipment Corporation
Houdaille-Hershey Corporation (3)
Hub Plating Works
Hudson Motor Car Company
Hy-Grade Plating Company
Illinois Watch Case Company
Industrial Filter & Pump Manufacturing Company
International Business Machines Corporation
International Nickel Co., Inc., The (5)
International Silver Company
Jones and Laughlin Steel Corporation
Kelly Plating Company, The
Knape & Vogt Manufacturing Company
Knight-Morley Corporation
Knight Plating Company
Kocour Company
Kohler Company
Kuehne Manufacturing Company
Lasalco, Inc.
Lea Manufacturing Company, The
Lea Manufacturing Company of Canada, Ltd.
Leeds & Northrup Company
Chas. F. L'Hommedieu & Sons Company
Lyon Incorporated
Maas & Waldstein Company
W. D. MacDermid Chemical Company
MacDermid, Incorporated
Magnuson Products Corporation
R. C. Mahoney
Manderscheid Company, The
Matchless Metal Polish Company, The
Mattatuck Manufacturing Company
Maurer Supply Company
McGean Chemical Company, The
Meaker Company, The
Mechanical Plating Company
B. Mercil & Sons Plating Company
Metal Finishers, Inc.
Metal Finishing Association of Southern California, Inc.
Metal Mouldings Corporation
Metal Process Corporation (2)
J. C. Miller Company (2)
Mitchell-Bradford Chemical Co., The
Modern Plating Company, The
Moore Drop Forging Company
Mutual Chemical Company of America
George L. Nankervis Company
National Aniline Division, Allied Chemical and Dye Corporation
National Brass Company
National Cash Register Company, The
National Lock Company
National Screw and Manufacturing Company, The
New England Buff Company
New England Plating Company
New Jersey Zinc Company (3)
G. J. Nickolas & Company
Noblitt-Sparks Industries, Inc.
Northwest Chemical Company (2)
Nutmeg Chrome Corporation
Oakite Products, Ind. (2)
Oneida, Ltd.
Packard Motor Car Company
Parker Rust-Proof Company
Pennsylvania Salt Manufacturing Company, The
Pheoll Manufacturing Company
Philadelphia Rust-Proof Company
Platers Supply Company
Plating Products Company, The
Products Finishing
R. C. A. Victor Division, Radio Corporation of America
R. W. Renton & Company
Reynolds-Robson Supply Company (2)
Roberts Rouge Company
G. S. Robins & Company
Roto-Finish Company
Royal Plating and Polishing Company
Scientific Control Laboratories
Scoville Manufacturing Company
E. E. Seeley Company, Inc.
Seymour Manufacturing Company, The
J. J. Siefen Company
Standard Plating Works
Standard Steel Spring Company (3)
Stanley Works, The
Frederic B. Stevens, Inc. (2)
George A. Stutz Manufacturing Company
Superior Steel Corporation
Sylvania Electric Products, Inc.
Talon, Inc.
Thomas & Son Company, The
Thomas Steel Company, The
Trico Products Corporation
Udylite Corporation, The (3)
Uncas Manufacturing Company
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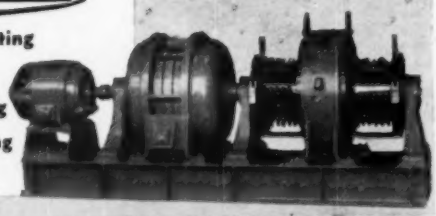

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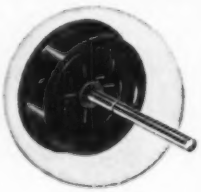
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NEUTRAL SALTS—For Complete Range of Temperatures.

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Cleaner No. 9 Heavy duty soak cleaner
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Cleaner No. 20 Non-etching Aluminum Cleaner
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Membership Report

(*Continued from page 200*)

son, Jack Curry, D. M. Johnson, E. S. Johnson, Stanley Krance, David Lord, Foster Laurie, Lawrence C. Mertz, Joseph Meyer, W. S. Morrison, Einar Olsen, Chester Paschelke, V. Pleascher, John J. Russel, Edward J. Ryan, Paul G. Sacheck, Stanley J. Shifferd, Stanley Skinner, B. J. Slivka, S. Stach, Robert J. Stell, Robert E. Stewart, Charles Stopper, James Supple, A. Sykes, Peter Szymanski, Walter Unger, John J. Valentine, Robert Walworth, T. A. Witt, Robert J. Witte

CLEVELAND BRANCH: James Cabalek, Edward Chapple, Theron G. Craig, Ralph L. Everstine, Joseph Gombos, Nathan Hartman, John S. Hoffman, Rober V. Kamphues, Joe Lechner, Charles A. Masek, Jay V. Muckley, Fred H. Nicholl, Emil Pavlik, Jerry Piskac, J. E. Rhoads, Carl Shoemaker, William M. Smith, Marshall A. Veigel

MONTREAL BRANCH: E. Boulet, M. Journet, E. H. Marsh, D. McDonald, G. Paquet, J. E. Plante, P. J. Sloane

PROVIDENCE-ATTLEBORO BRANCH: Louis E. Tarsa

ST. LOUIS BRANCH: Charles Bacon, Durward Cooley, Frank Cross, Dewaine Fricke, F. Fuselier, R. C. Jones, F. V. Moore, F. Nagoski, Wade Newbanks, J. A. Roland, K. E. Werling

Deaths

CINCINNATI BRANCH: Walter M. Mayer

PHILADELPHIA BRANCH: William Frank Mershon

ST. JOSEPH VALLEY BRANCH: Worth W. Mathews

Sustaining Membership List

(*Continued from page 201*)

United States Spring & Bumper Company
Van Der Horst Corporation of America
A. T. Wagner Company
Wagner Brothers
Wald Manufacturing Company
R. Wallace & Sons Manufacturing Company
Walton & Lonsbury
Warner Electric Company
Waterbury Companies, Inc.
Waterbury Plating Company
Weirton Steel Company
W. W. Wells, Limited
Western Electric Company
Western Rustproof Company
Westinghouse Electric Corporation
Wheeler Industries, Inc.
Winchester Repeating Arms Company
Winters & Crampton Corporation
Wollensak Optical Company
Worcester Brass Electro Plating Company
Wyandotte Chemicals Corporation
Yankee Metal Products Corporation

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Branch Secretaries and Research Chairmen

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1341 Norton Avenue, Columbus 12, Ohio

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Past President.....S. S. JOHNSTON
Weirton Steel Company, Weirton, W. Va.

Executive Secretary.....A. K. GRAHAM
P. O. Box 168, Jenkintown, Pa.

A. E. S. RESEARCH COMMITTEE

Chairman.....W. M. TUCKER
Eastman Kodak Company, Rochester 4, N. Y.
Secretary.....The Executive Secretary

LOCAL BRANCHES

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Thursday of each month. Secretary-Treasurer, James F. Riegel, 425 S. 18th Street, Allentown, Pa. Research Finance Committee Chairman, G. W. Ward, 212 N. 6th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of October, December, February, and April in Baltimore at the Engineers' Club, and of November, January, March, and May in Washington, D. C., at the Garden House, Dodge Hotel. Secretary, Vernon A. Lamb, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown, 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, H. A. Fudeman, 534 W. Ferry Street, Buffalo 13, N. Y. Research Finance Committee Chairman, B. P. Fortin, 200 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, J. M. Andrus, 3701 Ravenswood Avenue, Chicago 13, Ill. Research Finance Committee Chairman, Clyde Kelly, 740 W. Englewood, Chicago 21, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, H. Roper Davis, 6005 Yosemite Drive, Cincinnati 12, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Cleveland, Ohio. Research Finance Committee Chairman, E. C. Friedl, c/o du Pont Company, 1335 Guardian Building, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Nathan L. Koslin, 2641 Cleveland Avenue, Columbus 11, Ohio.

DAYTON meets first Monday of each month in Engineers Club. Secretary, Richard M. Clinehens, 701 W. Stewart Street, Dayton 8, Ohio. Research Finance Committee Chairman, C. W. Powell, 3112 Princeton Drive, Dayton 6, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, F. J. Darling, 3366 College Avenue, N. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Putte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH. Secretary, William G. Finlay, c/o The M. & Y. Products Limited, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary, H. Smith, 335 Whittier Place, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. F. Strefling, 1423 Kelsey Avenue, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Chester W. Smith, c/o Superior Metal Company, Bethlehem, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway West, Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Scully's Restaurant. Secretary, Myron H. Orbaugh, c/o Bone Engineering & Tool Company, 701 W. Broadway, Glendale 4, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Lousiville. Secretary-Treasurer, Stanley J. Beyer, c/o Hart Products, 915 E. Kentucky Street, Louisville 4, Ky. Research Finance Committee Chairman, Garland Logsdon, 1519 Central Avenue, Louisville, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Hon. Secretary-Treasurer, John J. Dale, c/o Defense Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, Harry J. Krueger, 1333 S. 71st Street, Milwaukee 14, Wis. Research Finance Committee Chairman.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, George R. King, P. O. Box 29, Montreal 30, Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets first and third Friday of each month at 8 P. M. in Hotel Robert Treet. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166–41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I., N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Al Hirsch, 1945 W. Airdrie Street, Philadelphia 40, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary-Treasurer, E. J. Smith, Chem. Dev. & Res. Lab., Weirton Steel Co. Weirton, W. Va Research Finance Committee Chairman, R. A. Woofter, 42 Hiland Ave., Emsworth, Pittsburgh 2, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary, Irving H. Eastman, 79 Spofford Road, Lakewood 5, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Ave., Attleboro, Mass.

ROCHESTER meets third Monday of each month in Ukranian-American Club. Secretary, Gordon W. MacDonald, North Bergen Road, R. D. No. 1, Bergen, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Spring Creek Road, Rockford, Ill. Research Finance Committee Chairman, Al Overbie, c/o National Lock Company, Rockford, Ill.

SAGINAW VALLEY meets for dinner at 7:00 P. M. and meeting at 8:00 P. M. at Rollie McNivens, Frankenmuth, Mich., second Wednesday of each month, September through May. Secretary-Treasurer, R. A. Nyquist, c/o Bay Manufacturing Division, Morton Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, Ray Friend, 1435 Howard Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester Avenue, St. Louis, Mo.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, John J. Meehan, 1345 16th Avenue, Apt. 4, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary, William Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, James Laing, 93 Woodbridge Street, South Hadley, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willamansett, Mass.

SYDNEY, AUSTRALIA. Secretary-Treasurer, T. O. Kolts, 7 King Street, Newtown, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Hotel Syracuse. Secretary, Kenneth Parnell, c/o Brown-Lipe-Chapin Division, General Motors Corporation, Syracuse, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio. Research Finance Committee Chairman, William Russell, 7th Street at Dixie Highway, Perrysburg, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, R. Stevens, c/o Bryden Brass Company, 927 Dufferin Street, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 316 Builders Exchange, Minneapolis 2, Minn. Research Finance Committee Chairman, Gunnar Deedon, 3650 47th Avenue S., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, Anthony Maz, c/o Risdon Manufacturing Company, Waterbury, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, D. E. Paton, c/o Sydenham Trading Company, Ltd., Wallaceburg, Ontario, Canada.

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plating

February 1, 1950

Dear Reader:

The renewed wave of confidence in the future of business which exists at the beginning of this year is demonstrated not only by the upward movement of the stock market but also in a number of smaller ways.

PLATING itself has felt it in the matter of contracts for advertising space. While such contracts do not reflect the expected advertising volume during a year (advertising contracts are cancellable and a number of advertisers prefer to operate without them) they do mirror the existing degree of business confidence.

Thus on December 31, 1949 the volume of contracted advertising in PLATING was 28 per cent higher than at the same time in 1948. Not until March 31 of last year did the contracted volume reach the new year-end value.

The same encouraging situation is found among New York City job platers, who toward the end of last year found themselves in a better situation than for quite some time.

It is notable that a good outlook in plating coincides with other promises of healthy business. Actually they are the same, because almost every metal manufacturing business makes use of plating to at least some extent.

Sincerely,

Gustaf Soderberg

Future Meetings

DAYTON BRANCH, A. E. S. 5th Annual Educational Session (1:30 P. M.) and Dinner-Dance (6:15 P. M.) in Hotel Biltmore on Saturday, February 25.

AMERICAN SOCIETY FOR TESTING MATERIALS Committee Week and Spring Meeting in Hotel William Penn, Pittsburgh, Pa., on February 27–March 3.

NATIONAL PRODUCTION EXPOSITION of the Chicago Technical Societies Council in Stevens Hotel, April 4–8, 1:00–10:00 P. M.

THE ELECTROCHEMICAL SOCIETY, 97th Meeting in Statler Hotel, Cleveland, Ohio on April 19–22.

ELECTRODEPOSITORS' TECHNICAL SOCIETY Silver Jubilee and Annual Conference in Grand Hotel, Eastbourne, England on April 19–22.

AMERICAN ELECTROPLATERS' SOCIETY 37th Annual Convention and the 4th International Conference on Electrodeposition in Statler Hotel, Boston, Mass., on June 12–15.

AMERICAN SOCIETY FOR TESTING MATERIALS 53rd Annual Meeting and 9th Exhibit of Testing Apparatus and Related Equipment in Chalfonte-Haddon Hall, Atlantic City, N. J., on June 26–30.

INDUSTRIAL FINISHES EXHIBITION at Earle Court, Kensington, London, England on August 30–September 7.

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for NICKEL PLATING

The one bath especially designed for plating DIRECTLY on WHITE METAL ALLOYS including ZINC, LEAD and ALUMINUM. ZIALITE also plates on COPPER, BRASS and IRON.

for HARD CHROMIUM

USE Zialite ADDITION AGENTS

Finer-grained deposits.
Increased throwing power.
Less sensitivity to sulfate content.

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92 Grove Street Worcester 5, Mass.

USE READER SERVICE CARD: INDICATE A 139.

Get To The Heart
of your finishing problems
with CHROMETEX
Try this improved, fast-acting, more positive Nickel Activator which will increase the covering power of your Chrome — eliminate grey streak and clouds — assist in covering deep recesses of nickel — aids in plating nickel on nickel.
Notice how Chrometex reduces passive nickel due to solution impurities, poor rinsing or excessive heat, thereby assuring bright chrome coverage over entire plated article.
Compare Chrometex with other Activators! A 10 to 15% sulfuric acid dip containing CHROMETEX at room temperature and cold water rinse is all that is necessary prior to chrome plating (Use only 0.4 oz. per gallon or 2.5 pounds per 100 gallons).
CHROMETEX is a dry acidic powdered salt packaged in 1, 5 and 25 pound containers.
Send For Free Data Sheets
MAC DERMID
Incorporated
WATERBURY 20. CONNECTICUT
COMPOUNDS AND EQUIPMENT FOR METAL FINISHING

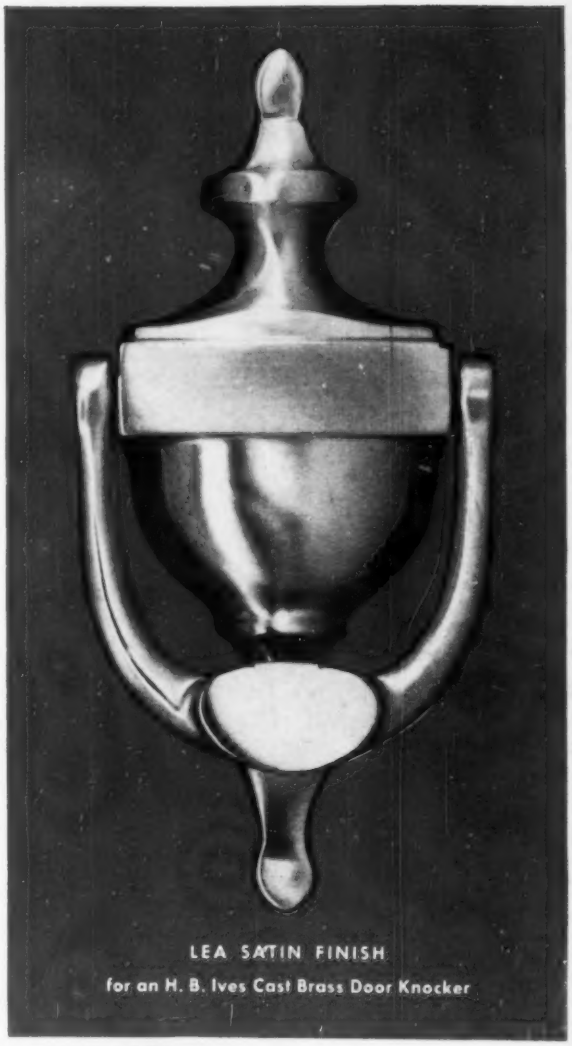
Sales Appeal Finishes

with

LEA methods
LEA compounds

This Ives Door Knocker is a fine example of a "Sales Appeal Finish." It is typical of the numerous and varied cast brass hardware items produced by the H. B. Ives Company of New Haven and finished in a Lea Satin Finish. The attractive, delicate Satin Finish on this knocker is produced by using Grade B Lea Compound on an 8" loose muslin buff at 2400 rpm. This method eliminates a Tripoli operation and 2 cleaning operations . . . a faster, cleaner, more economical job.

If you have a polishing or buffing station in your production line perhaps we can show you how to get a higher finishing quality at a lower cost. And if you have any burring problems, we can help you with them too.



LEA SATIN FINISH
for an H. B. Ives Cast Brass Door Knocker

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Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions

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